

8b
NK
9930
. D5
1895

FRETWORK AND MARQUETRY

“COAGULINE”

(TRADE MARK).

A TRANSPARENT CEMENT

OF INFINITE UTILITY FOR

BROKEN ARTICLES.

Its Adhesiveness and Tenacity are Truly Extraordinary.

“CLEAR AS CRYSTAL,”

“STRONGER THAN GLASS,”

“TOUGH AS LEATHER.”

Unites Wood, Glass, China, and Earthenware,
Bone, Ivory, Leather, Papier-mache,
Fossils, Shells, Minerals, Stone, Plaster Models,
Statuary, Picture Frames, &c.

PRICES:

6d., 1s., and 2s. Postage 1d.

SOLD EVERYWHERE.

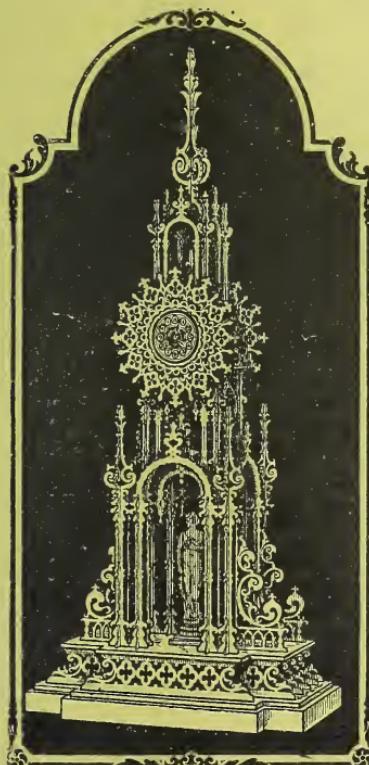
PRIZE MEDAL, LEEDS, 1868. SILVER MEDAL, LONDON, 1870.

SOLE PROPRIETORS AND MANUFACTURERS :

**KAY BROTHERS Ltd.,
STOCKPORT.**

TO FRET WORKERS.

THE GREAT CENTURY CLOCK DESIGN *GIVEN AWAY.*



THE GREAT CENTURY
CLOCK DESIGN.

Size 48in. by 22in.

(May be cut with ordinary hand-saw).

FRETEWORKERS may now obtain our New Illustrated Catalogue of Designs, Tools, and all materials for Fretwork, Wood-Carving, Bent Iron Work, &c., price 6d. This is by far the largest and most complete Fretwork Catalogue ever published. No fewer than 48 pages have been added since last year, and the list now contains

120 PAGES,

WITH MANY HUNDREDS OF ILLUSTRATIONS

One of the special features of our New Catalogue is the complete illustrated list of the renowned

HOBBIES DESIGNS,

including the handsome Special Designs. The cost of preparing this Catalogue has been enormous, and each will have to be sent by Parcels Post at a cost of 3d. We are, therefore, obliged to make a charge of 6d. per copy for the Catalogue, a sum which, of course, does not pay the mere cost of printing and postage, leaving altogether out of account the enormous preliminary expense in preparing Illustrations, &c. We, however, give with each Catalogue a Coupon, entitling Customers to a rebate of 6d. on any order for 10s. worth of Goods. We also send as

A Free Present

with each Catalogue an exceptionally fine Fretwork Design (published at 1s.) of THE GREAT CENTURY CLOCK, of which an Illustration is given. This Design is printed on two Large Sheets, each 40in. by 25in., full instructions being supplied.

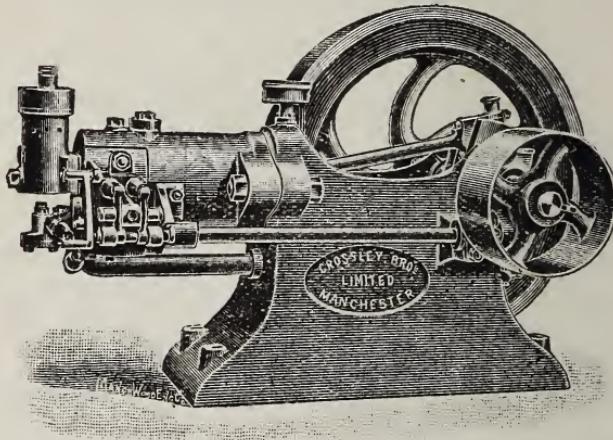
 Send at once Sixpence
for Catalogue and Presenta-
tion Design.

—0—

HOBBIES LIMITED,
DEREHAM, NORFOLK.

CROSSLEY'S GAS ENGINES.

Can be Supplied on the Deferred Payments System.



The annexed Illustration represents our New Pattern 8 man, $\frac{1}{2}$ horse, and 1 horse power nominal Engines, capable of working up to $1\frac{1}{2}$ horse, 2 horse, and 3 horse respectively actual. The power has been greatly increased, and the gas consumption reduced. The materials and workmanship throughout are of the best possible description, the crank shafts and connecting rods being cut out of solid steel forgings, turned and polished, flywheel and pulley turned.

Patent highly sensitive Governor, **regulating gas consumption in proportion to work done.** New porcelain indestructible ignition tube. Loose cylinder liner and pistons of hard metal. The Engines are thoroughly tested before leaving the works.

They can be started in a few Minutes, and left running without attention for Hours.

CROSSLEY BROS., Ltd.,
Otto Gas Engine Works, OPENSHAW,
MANCHESTER.

FRETTWORK & MARQUETRY.

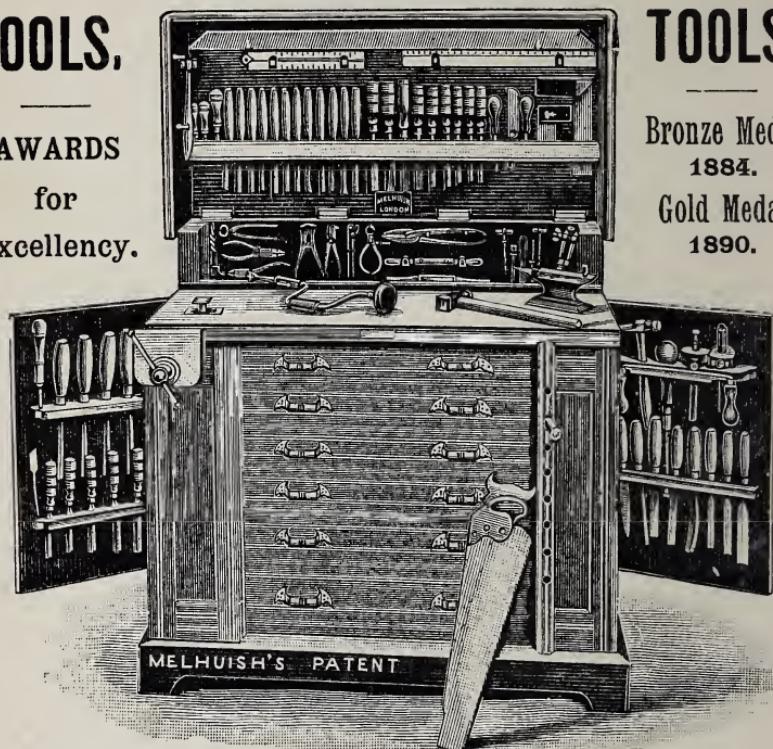
WORK-BENCH AND TOOL-CABINET.

Closed easy, with small Lock and Key. Fitted complete with our famous Tools in Wainscot Oak, polished, all of the best workmanship; and assortment of Fine Nails, Pins, Brass Screws, Fittings.

£19 2s. Od.

TOOLS.

AWARDS
for
Excellency.



TOOLS.

Bronze Medal
1884.
Gold Medal
1890.

ALL TOOLS FIRST QUALITY AND FULL SIZE FOR PRACTICAL WORKMEN.
TOOL CHESTS, fitted complete with our Famous Tools, from 7s. to £3 7s. Od.
We hold the most Complete Stock of Hardware and Tools in this country.

Our Famous Catalogue of Tools

Is the largest and most complete, contains Hints and Instructions for Wood Carving and Marquetry Work.

SEND FOR LIST.

MELHUISH, SONS & CO.,
84, 85, 87, FETTER LANE, LONDON, E.C.

FRETWORK AND MARQUETRY:

A PRACTICAL MANUAL
OF INSTRUCTIONS
IN THE ART OF FRET-CUTTING
AND MARQUETRY WORK.

BY D. DENNING.
Author of "Polishes and Stains for Woods," &c.

ILLUSTRATED.

LONDON:
L. UPCOTT GILL, 170, STRAND, W.C.

LONDON :
L. UPCOTT GILL, LONDON AND COUNTY PRINTING WORKS,
DRURY LANE, W.C.



PREFACE.

IN the ever-growing attention which is being paid to the cultivation of mechanical and artistic work as a hobby, it seems strange that Marquetry or Inlaying should have received such scant attention. It is, perhaps, because the methods adopted are so little known that this is the case. Fretwork is in itself rather too apt to be considered as a too trivial pursuit to be regarded seriously; but there is no reason why such should be so. Much beautiful decoration can be produced by it alone, while the more artistic and valuable Marquetry cannot be done till proficiency in simple Fretwork has been attained.

The endeavour in the following pages has been to give instructions which will enable the learner to dispense with ocular and oral demonstration, and it is not too much to say that careful attention to the directions will enable any one to acquire the necessary theoretical knowledge. Practical proficiency can, however, only be acquired by experience.

May 30, 1895.

FRETTWORK, CARVING, INLAYING, PAINTING, POKER, AND Art Metal Work Designs & Materials.



LISTS FREE.

Catalogues Nos. 59, 60, 61, and 62, with
2,850 Illustrations, **6d.**

~~~~~  
**HENRY ZILLES & CO.,**  
**IMPORTERS,**  
**19 & 21, WILSON ST., FINSBURY, LONDON, E.C.**

## Woodcarving for Amateurs.

Full Instructions for producing all the different varieties of Carvings.  
SECOND EDITION. Edition by D. DENNING. *In paper, price 1s., by post 1s. 2d.*

## Workshop Makeshifts.

Being a Collection of Practical Hints and Suggestions for the use of Amateur Workers in Wood and Metal. By H. J. S. CASSALL. Fully Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

## Toymaking for Amateurs.

Being Instructions for the Home Construction of Simple Wooden Toys, and of others that are Moved or Driven by Weights, Clockwork, Steam, Electricity, &c. Illustrated. By JAS. LUKIN, B.A. *In cloth gilt, price 2s. 6d., by post 2s. 10d.*

## Turning for Amateurs.

Being Descriptions of the Lathe and its Attachments and Tools, with Minute Instructions for their Effective Use on Wood, Metal, Ivory, and other Materials. Second Edition, Revised and Enlarged. By JAMES LUKIN, B.A. Illustrated with 144 Engravings. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

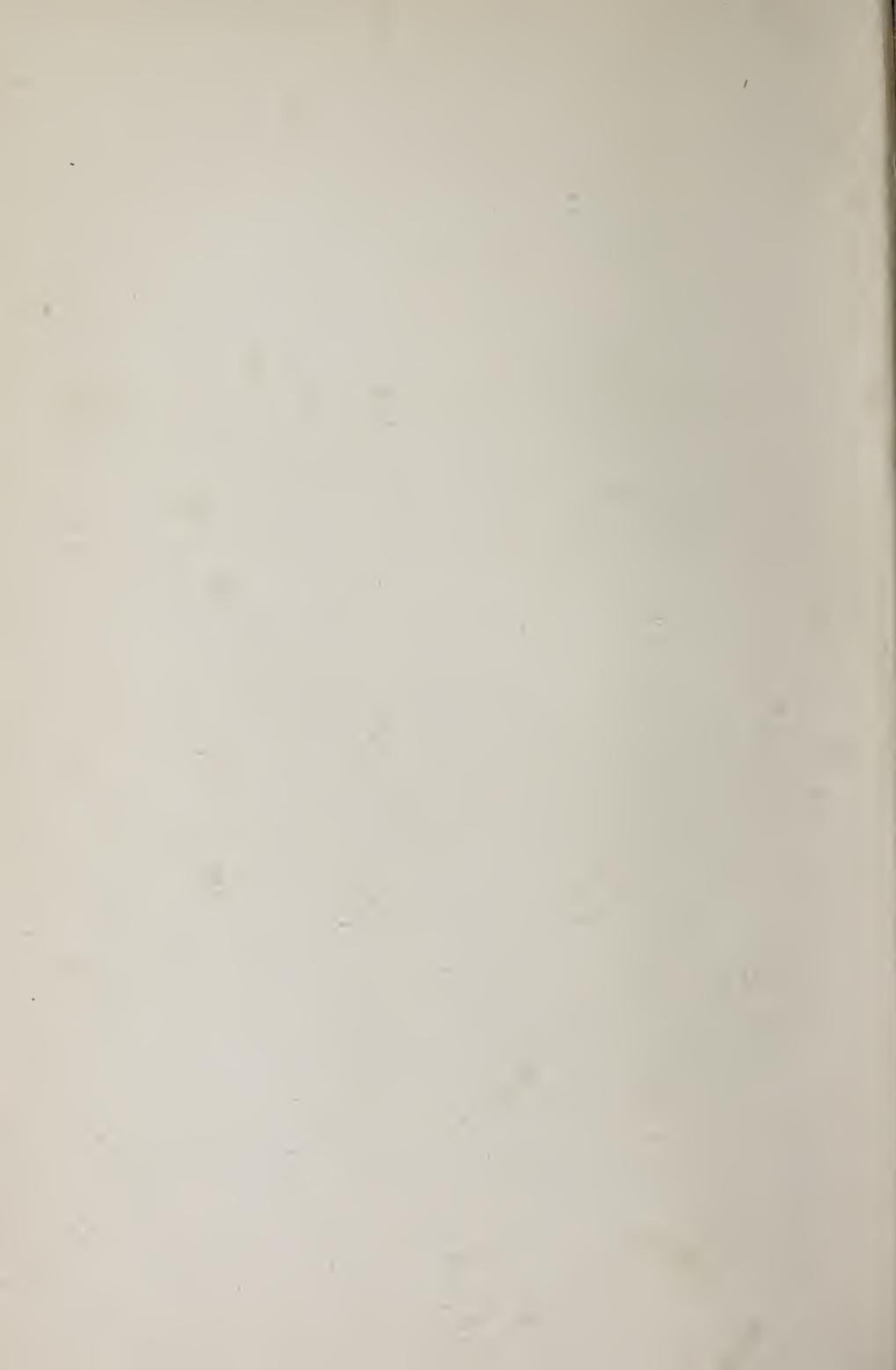
## Cane Basket Work.

A Practical Manual on Weaving Useful and Fancy Baskets. By ANNIE FIRTH. Illustrated. *In cloth gilt, price 1s. 6d. by post 1s. 8d.*

~~~~~  
LONDON : L. UPCOTT GILL, 170, STRAND, W.C.

CONTENTS.

CHAP.	PAGE.
I.—Introductory	1
II.—Necessary Tools	4
III.—Useful Tools and Appliances	15
IV.—Machines for Fretcutters	22
V.—Home-made Tools and Appliances	31
VI.—Materials	39
VII.—Exercises in Sawing with the Hand-frame and the Machine	50
VIII.—Advanced Exercises for Sawing and Machine Work	61
IX.—Cutting Angles and Various Outlines	66
X.—Designs for Fretwork, and How to Use Them	73
XI.—Making up Fretwork Articles	87
XII.—Working in Metals and Xylonite	100
XIII.—Polishing, Staining, and Bleaching	104
XIV.—Inlaying and Marquetry	112
XV.—Plain Inlaying	115
XVI.—Easy Inlaying with Several Materials	123
XVII.—Marquetry Inlaying	127
XVIII.—Making up Inlays and Marquetry	133
XIX.—Shading Inlays, Making and Laying Stringings	140
XX.—The Marquetry-cutters' Donkey: How to Make, and How to Use It	149



FRETTWORK AND MARQUETRY.

CHAPTER I.

INTRODUCTORY.

FT has been said that "happy is the man who has a hobby," and we feel almost tempted to add "especially if it is a mechanical one." At one time, and that not so very long ago, the man who chose a handicraft as a pastime would have been looked on as an eccentric individual. Now he can indulge his mechanical tastes to his heart's content without exciting more comment than if he applied himself to what are somewhat invidiously called the fine arts. To class fretwork among these may seem rank heresy to some of those who regard fine art as of the most limited application.

But is not fretwork entitled to be considered as such, a minor one if you like, but still decidedly an art? Whether the result is artistic or otherwise depends on circumstances. If there are any readers who object to fretworking being considered as a fine art, they may be reminded that marquetry inlays are but the results of the skilful application of the fretsaw. Those who have not been accustomed to regard this art-craft as worthy of serious consideration will do well to visit the Jones' collection of inlaid furniture at the South Kensington Museum. In it they will find some of the finest specimens in existence, the work of Roentgen, Oeben, Riesener Boulle, or, as it is often written, Buhl, and other masters of the art.

From such high-class work as the beautiful marquetry referred to, to ordinary fretwork may appear a wide jump and too remote for them to bear comparison with each other. Practically, however, they are the same thing, so that the maker of a simple fret-work bracket made from an old cigar-box need not despair of being in time able to form the most elaborate inlays.

Perhaps one great charm about fretworking as an amusement is the small cost at which it can be indulged in, as neither the tools nor the materials are expensive. The tools and appliances really necessary need not cost more than a few shillings, while a really excellent outfit embracing everything that can be of advantage in connection with the art may be obtained for a comparatively small sum.

Another attraction which fretworking has for many is the fact that no place specially set apart as a workroom is required. All that is to be done can be done in an ordinary living room without creating an upset. Though, if the fretworker has a room that he can devote to the purposes of a workshop, so much the better, but it is not indispensable.

There is among many people an impression that fretwork articles are of necessity fragile. That many things from the way they are executed are fragile cannot be disputed, but with proper care and forethought, both in the selection of material and in its disposition, there is no reason why this reproach should be a just one. Of course, as fretwork is ornamental in its intention, it would be unreasonable for anything which must be subjected to hard wear and tear to be much embellished with it. Due regard must be paid to the use of the article which is fretted. If this is done, fretwork need not be regarded as a flimsy method of decoration.

The objection has been raised to fretwork that "there is nothing in it," that the work is puerile, and so on. Those who say so can hardly be aware of the enormous number and variety of designs which are procurable. Some of them, it is true, are of a simple character to suit beginners, but others require much skill to do them justice. We are no longer confined to a limited choice of a few brackets, glove, handkerchief, and work boxes, and other trifles of a similar character. Designs for objects of both a useful and an ornamental character can now be got in an almost bewildering number, and they are constantly being produced. It is our intention to show as we proceed not only how to do ordinary fretwork, but after this has been thoroughly dealt with

to describe equally fully how the finest marquetry is produced. The tools used, the methods practised, together with every detail which it is essential for either the plain fretcutter or the marquetry-cutter to know, will be found treated in such a manner as is hoped will be intelligible to all, and form a reliable guide to both amateur and professional.

CHAPTER II.

NECESSARY TOOLS.

ES was stated in the previous chapter, the tools absolutely required by the fretsawyer are neither numerous nor costly. To get a really full outfit of tools at the beginning is not at all necessary or desirable. Let them rather be purchased as they are wanted, or as it is found that their possession would be of advantage. To get a number of tools before they are required or before they can be used will probably result in the purchaser finding that he has got some things which he finds useless to him, and that others would have suited his particular requirements better. In a word, he gains experience as he progresses and is thereby able to a great extent to select those tools which seem as though they would suit him best. Individual workers may confine themselves to some particular kind of work, or to a limited branch of the fretworker's craft in which some of the tools mentioned will be comparatively useless. For example, it is quite conceivable that some readers may only do the fretcutting themselves and get the fitting together of the parts done for them. They will then naturally have no occasion to use any but fretcutting tools, so that it would be simply waste to provide themselves with others, although these are necessary to anyone who prefers to make up his own work.

We strongly recommend only the purchase of tools of good quality. Inferior ones may cost a little less at the outset, but they are never satisfactory or pleasant to use. As many tools or contrivances may be made at home by the amateur, we shall devote some space later on to a description of such, with sufficient details to enable those who have some knowledge of woodworking to make them.

Saw Blades.—The saws, or as they are so often called saw-blades, are thin narrow pieces of steel the ordinary length of which is from $4\frac{3}{4}$ in. to a little more than 5 in. One, the cutting, edge is serrated with the exception of a short space at the ends. The saws are made up and sold in bundles of a dozen. Most of them are of foreign production, but wherever they are made the saws are very much alike both in appearance and quality. In addition to the continental saws there are at least two well-known makes hailing from the United States which have very marked differences from the others. In the European saws the teeth closely resemble those of ordinary saws, except that they have generally very little or no set. This "set," it may be explained, is the technical word signifying the slight sideways bend which is given to the teeth and is necessary to allow an ordinary saw to pass freely through the wood without binding. Fretsaws being very narrow, the set is not required with them. Whatever the country of their origin, the size of the saw is known by a number. The standards vary slightly among different makers, but to so small an extent that there is for all practical purposes no difference. The numbers run from 000, which are the finest, to 12, the largest used for ordinary purposes. It is seldom that the three finest blades, viz., those known as 000, 00, and 0 will be wanted, and the beginner at any rate will have no use for them. The sizes 1 to 6 are the most useful, though those represented by the higher numbers 7 to 12 may sometimes be used with advantage. Good saws suitable for wood can be obtained for from 2d. to 3d. per dozen, though by purchasing them by the gross a considerable saving is generally effected. The larger-sized blades are rather more expensive and are not always easily met with. Although very much lower priced saws are to be had occasionally, they are mostly defective. Even in the best-known makes a uniform good quality must not be expected, for it is rare to get a dozen blades without some of them being more or less imperfect. Very often it is impossible to detect the imperfect blades without an actual test of their cutting qualities, but a little experience will often enable the user to pick out the faulty ones without taking so much trouble. The sharpness of the blade may be fairly judged by drawing the edge between the fingers, so that the points of the teeth catch. Of course this test can only be applied by drawing the saws in their cutting direction. Occasionally it may be noticed that the blade has a twist. Such a saw is seldom of any use, but on this as on many other points experience is the only reliable guide. Sometimes,

owing to defective tempering of the metal or to its having been accidentally filed too deeply between teeth, the blade snaps as soon as an attempt to use it is made. Such a defect is unmistakable. Other saw blades in which there is apparently no fault are difficult to saw regularly with. They seem to wander from the line from pure "cussedness." Such a blade, however good it may be otherwise, is not worth bothering with. The novice, however, must be very careful about discarding a saw for any supposed eccentricity of the sort, or he will be throwing all or nearly all his blades away, for he will find that none of them will keep to the line at first. It would perhaps be better to say that he will not be able to keep them to it, for it will be some time before he can do very accurate work. At first the blade will seem as though it would cut anywhere but just where it ought. In the majority of instances let the learner console himself with the reflection that the most expert fretcutter found just the same difficulty with his saw-blades till he acquired skill in using them.

For metal fretsawing a harder blade than that usually employed will be found necessary. These saws are rather more expensive than the ordinary kind, about 4d. per dozen being generally charged for them. The beginner is advised not to attempt cutting metal, or indeed any exceptionally hard material, till he has made considerable progress with something easier to manipulate.

Among American saws the Griffin and Star blades have deservedly a good reputation. Though not quite alike, there is a considerable resemblance between them and a marked difference from the ordinary saws in the construction of the teeth, which are very wide apart. We do not, however, recommend them for metal work. The saw known as the Hibernia is also popular. There is no difference between them and the Star saws. For all-round work either of the American blades may be safely recommended, either with the hand frame or with the machine.

In addition to saws of the ordinary kind, there are at least two fancy makes, which the worker is likely to meet with or to hear about as his experience widens, and about which he may expect some information here. As is very well known, an ordinary saw has only one cutting edge, and can therefore only cut in one direction. If, however, there were teeth on both edges, or what we call the back as well as on the front of a saw, it could be worked to cut either backwards or forwards as occasion might require. This idea has been embodied in the double-edged fretsaw blade. It is not one which we can commend and we have discarded it long ago. The

other out-of-the-way blade is a comparatively recent introduction. It is so arranged that it not only cuts backwards or forwards, but in any direction. It may best be described by comparing it with a piece of wire with teeth projecting in all directions, though it is really a saw of ordinary formation twisted in such a way as to present teeth in each direction. It is just conceivable that such a saw might sometimes be useful, though we have not found it so in our own practice. The difficulty of working it is one objection, it is impossible to cut out sharp corners with it. The slightest deviation in feeding the wood to the blade or a pressure sideways causes the blade to cut where it should not. With an ordinary blade only one edge cuts, and it will be quite as much as the sawyer can do to prevent it cutting unevenly, at least till he has acquired some skill. How much greater, therefore, the difficulty of guiding a blade which cuts equally in all directions? We would strongly caution the beginner not to use them as part of his regular outfit, till he is able to work the common blades so freely that he is competent to discern any advantages there may be in the others.

There is yet another kind of saw which we much like, but in the machine only, as it is too coarse for the small hand-frame. From this it will be gathered that the blade itself is only suitable for comparatively thick or heavy work. It is not one which is recognised as part of the fretworker's regular outfit, to which, however, it may with advantage be added for such sawing as has been indicated. We refer to a piece of an old fine band saw which has been repeatedly sharpened till it is very narrow. As such a piece of saw is not always to be met with, those who think it might come in handy sometimes are advised to watch their opportunity and get it when they can. The beginner need not lay in a large assortment of saws, and the sizes most likely to be useful to him are the medium. If he gets a few of No. 3 or 4 he will have sufficient to make a start with.

Afterwards he will easily be able to know what sizes are the best adapted to any work he may have in hand. At no time will he ever require to have a full assortment of all the sizes that are made. With two or three sizes carefully selected, anything that he is likely to attempt can be accomplished. The gradations in size are extremely minute, so that it is quite impossible to say that because a given number may not suit, that the next to it will do perfectly. There is considerable latitude allowable, and for all practical purposes it is sufficient to classify one's stock of saw-

blades into three lots, viz., large, medium, and small. For general purposes a No. 4 does very well, and it may be taken as the medium. It is generally better to use as large a saw as is convenient instead of a smaller one, not so much because the large saw cuts quicker, as because it is stronger, and is not so easily broken. As the saw blade has no stability in itself it cannot be regarded as a complete tool without something to hold it rigid. This may be either a hand-frame or machine, one or other of which must form part of the fretsawyer's outfit. As there are many varieties of machines, some of the principal will be found described in a chapter devoted to them alone. The humbler hand-frame will be first described, as it will be well for the learner to be able to use it even if he should do most of his cutting with the aid of a machine.

Saw Frames.—The hand-frame is indispensable to the fretcutter who must study economy, and we recommend even those who ultimately intend to get a machine to practise with the frame till they are fairly expert in using it. Very fair frames may be bought for 1s. each, or even less occasionally, and prices range up to several shillings, according to size and quality. A really excellent frame may be bought for about 3s. 6d. The frames are mostly made of steel, though, on account of their lightness, those made of wood are to be preferred generally. Taking the ordinary steel or iron frame, fig. 1 gives a representation of a cheap form. In it the saw clamps which hold the blades are fixtures and beyond opening to receive the ends of the blades they cannot be moved.

In fig. 2 a superior make of frame is shown. In it

the saw-clamps are movable, so that within reasonable limits they can be made available for broken saws. The chief advantage, however, of having movable jaws or clamps is that they can be

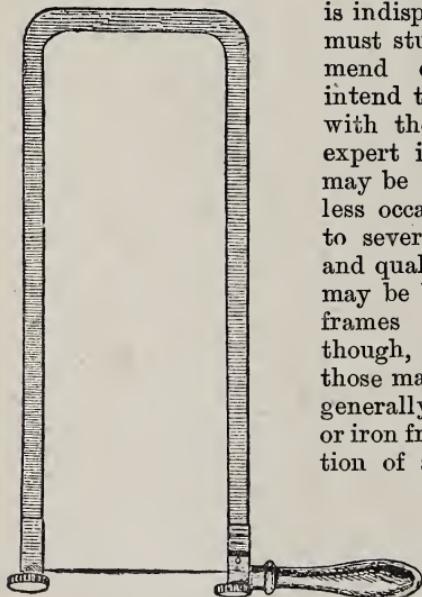


FIG. 1. SIMPLE HAND-FRAME.

turned to face sideways so that the saw can be made to cut in either direction and not merely forward from the back of the frame. By reason of this adaptability much larger pieces of wood can be operated on with a comparatively small frame to

what would be required with fixed jaws. Fig. 3 represents really an excellent form of wooden frame, and is the kind used by professional marquetry-cutters. It is both strong and light, so that it may be used with the minimum of fatigue, and having movable clamps is in this respect equal to the most expensive metal frames.

For the benefit of those who prefer to make their own frames, directions will be found later on founded on the model of one we use ourselves. As the size of frames has been

referred to, it may be well to explain that this is reckoned according to the distance between the saw-blade and the back part of the frame. Thus a 12in. frame will allow of a straight line of that length being sawn from the edge of a piece of wood towards its centre, or by facing the saw sideways a cut of any length at that distance from the edge. A 12in. frame is a very useful size, and anything over 16 inches may be regarded as being rather too cumbersome, especially if it is of metal. The illustrations given may be taken as types of the frames principally used, but there are two others of a distinct variety which may later on with advantage be added to the outfit. One of these is the small frame shown in fig. 4, and known as a jeweller's bow-saw. It will be found very useful on account of its small and handy size, when sawing metal, which is seldom fretted in large pieces. It can be adjusted to almost

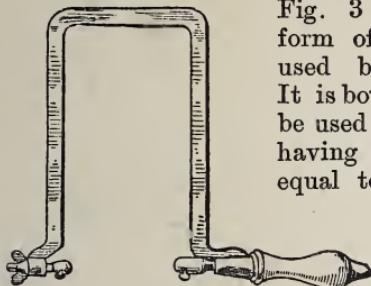


FIG. 2. USEFUL HAND-FRAME.

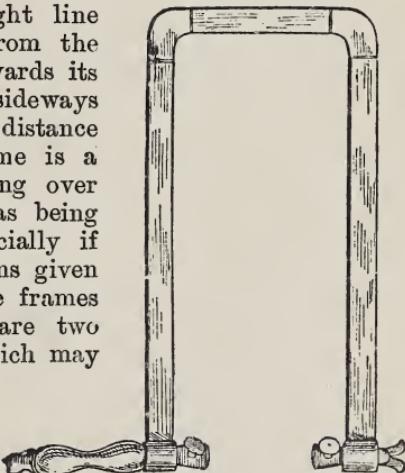


FIG. 3. WOODEN-FRAME.

any extent to take small lengths of broken blades. It is more likely to be met with at the ordinary tool dealers than at the fretwork specialists. The same may be said of the ordinary

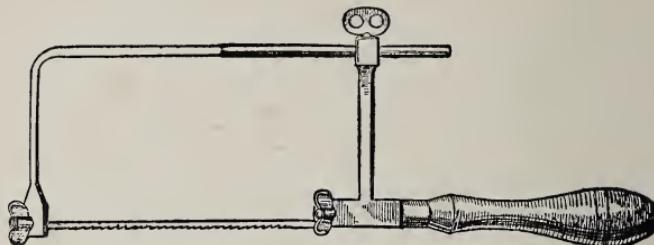


FIG. 4. JEWELLER'S BOW-SAW.

cabinet-maker's bow-saw shown in fig. 5. This is useful for thicker wood than could be conveniently cut with the ordinary fretsaws. The blades used with it are strong and heavy. They are obtainable at any tool shop, and are sold at prices regulated by

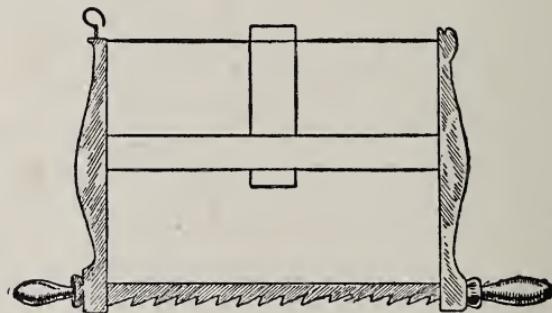


FIG. 5. CABINET-MAKER'S BOW-SAW.

their length, generally at the rate of about 1d. per inch. As the frames are entirely of wood, they may be classed among those tools which the worker can make for his own use, and a detailed description will be found later on.

Ordinary and Tenon Saws.—For sawing boards into lengths or pieces with straight edges and making up articles of

fretwork generally a small saw of the usual kind will be found very convenient. A tenon saw, as shown in fig. 6, will be found very useful, though it must be observed that this tool is perhaps not indispensable although it is alluded to among the necessary articles. Speaking generally, it may be said that the usual tools of the

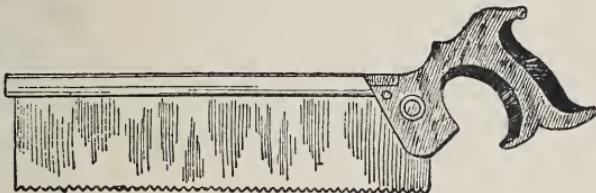


FIG. 6. TENON SAW.

cabinet-maker will be found useful at some time or other to the fretcutter who makes up his own work. This is indeed nothing but cabinet-making on a small scale. We have, however, not so much concern with these as with the tools which are either absolutely necessary or of special utility to the fretcutter.

Boring Tools.—These cannot be dispensed with. That which finds most favour among fretcutters is the drill, as with it holes can be bored cleanly and without risk of splitting the wood. The



FIG. 7. ORDINARY DRILL.

drills or bits are made in various sizes. The ordinary form is shown in fig. 7. Only one or two of them will be required, say one of medium size which will make a hole large enough for any saw to pass through, and a small one to use when the waste wood is not

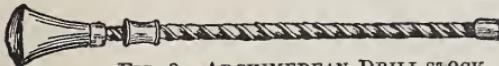


FIG. 8. ARCHIMEDEAN DRILL-STOCK.

big enough to allow of a hole being made in it with the large drill without damaging the design to be cut. To use the drill a stock of some sort is required to rotate the drill rapidly. Fig. 8 represents the common or so-called Archimedean drill-stock,

which can be got with two or three drills as low as 6d. Drills worked by these stocks are only cutting during the downward stroke of the small sliding handle. With another form of stock represented in fig. 9 the cutting is continuous.

A common bradawl or a gimlet may be used instead of a drill, but neither of them is so suitable on account of the liability of splitting the wood. There is also the objection that very small holes which are often necessary cannot be made with them. With a bradawl properly used the risk of a split as well as a hole resulting is comparatively small. The tool is such a useful one in making up fretwork that even if a drill is preferred the novice

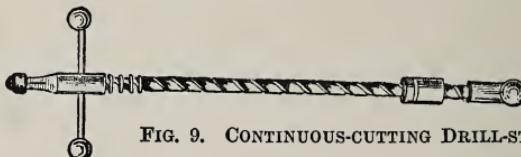


FIG. 9. CONTINUOUS-CUTTING DRILL-STOCK.

ought to know how to use it. The directions are very simple. When beginning to bore see that the edge of the blade is across the grain of the wood and not parallel with it. The edge then cuts the fibres of the wood instead of splitting them apart. When boring with the bradawl the hole is not made by continuously turning the tool round, as with a gimlet, but by a slight rotary movement with pressure. The use of the gimlet is so well known and so obvious that no remarks need be made about it.

For the purpose of slightly enlarging holes, as is sometimes necessary, the tool known as a broach is very useful, but it seldom forms part of the fretworker's outfit.

For making round holes, which form a part of many designs, the ordinary brace or stock and bits of the joiner are often better than the saw, *i.e.*, it is easier to bore a large round hole than to cut it.

Cutting-Board.—Although fretsawing may be done without it, it is still so useful that it may almost be regarded as indispensable. If it is only to save the table from being accidentally injured with the saw, one should be got, but beyond this it forms a most convenient support to the wood while being sawn and much reduces the risk of delicate work

being broken. In itself the cutting-board is merely a piece of board of convenient size to support the fret, or at any rate that part of it which is being worked on. In the front of it there is an opening, usually of a V shape, to allow of the saw working in it. As sold usually it has a wooden screw or cramp to fix it to the table with, as shown in fig. 10. It will be understood that the cutting-board is only useful with the hand-frame. Those who use a machine will not require it.

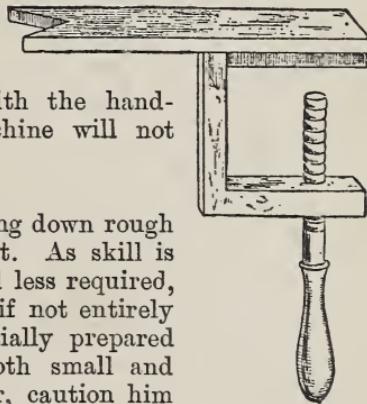


FIG. 10.
CUTTING-BOARD.

Files.—These are for smoothing down rough cuts and getting outlines correct. As skill is acquired the file will be less and less required, till at last its use may be almost if not entirely dispensed with. The files specially prepared for the fretcutter's use are both small and inexpensive. We may, however, caution him not to indulge in careless sawing with the notion that files will put everything right. It ought not to be necessary to "improve" on the work of the saw by filing each cut. It is often possible to use glass paper with greater advantage and more conveniently than files, though these must be used when the fret is in metal and when sharp inside corners have to be cleaned up. The most convenient way of using glass-paper will be found described later on.

Scraper.—This is a thin flat piece of steel used for the purpose of scraping wood perfectly smooth, and for small work will be found more convenient than the plane for finishing off. The chief difficulty in connection with it is the sharpening, for unless this is done properly the tool is almost useless. The effort should be to get a sharp square edge slightly burred over and not a rounded one. This is managed by drawing a piece of steel, such as the back of a gouge or a scraper sharpener, along the edge, but those who do not know how to do what is required cannot do better than get a cabinet-maker or joiner to show them, as mere verbal description is hardly sufficient. It is specially useful for hard wood.

Screw-drivers.—One or two of these will be found necessary in making up work, as it does not always answer to depend on glue alone, and screws are often better than nails for fastening pieces together. The screw-driver is seldom needed of large size, indeed, for most fretwork a large-sized bradawl is better or at least quite as effectual and considerably cheaper.

Hammer.—It is not necessary to say more than that one will be required, and that one of small size will be the most convenient.

As has been said, many of the tools required by the cabinet-maker will come in handy to the fretsawyer who makes up his own work, and the most useful of these will be cursorily glanced at in the next chapter.

CHAPTER III.

USEFUL TOOLS AND APPLIANCES.

ELTHOUGH cabinet-maker's tools are useful to the fretworker, it must not be supposed that in all cases they need be so large in size as those ordinarily met with in the workshop. As a rule the smaller kinds will be much more convenient to the amateur. For instance, the large jack plane is not necessary to reduce the roughness of boards, nor is the trying plane necessary to shoot straight edges with. Small planes will do all that is required.

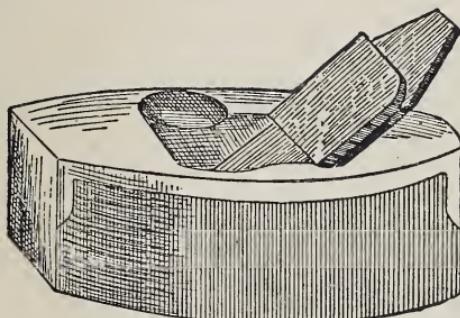


FIG. 11. SMOOTHING PLANE.

Planes.—These, as is well known, are used to take the roughness left by the saw from surfaces and edges of boards, as well as to reduce them slightly in size. Several varieties are used for the purpose, but the fretcutter can manage very well with one, or at most two, as the wood he has to manipulate is almost entirely in small pieces. If he does not wish for more rough work than can

be helped he will buy his wood at least partially smoothed, so that he has, as it were, to give it only the finishing touches. For this purpose a smoothing plane, illustrated in fig. 11, will do admirably. One with a double iron should be preferred, though a little more expensive than a single iron plane. There are also sundry small iron planes sold at very low prices. With even the smallest almost everything that is necessary may be done, especially if the side of the plane is flat. The reason for preference being given to one with a flat side is that with it edges may be shot straight in conjunction with the shooting-board more conveniently than when the plane has a rounded side. As iron planes of the cheaper kind are generally japanned black before they can be used comfortably with the shooting-board, this coating should be rubbed or scraped off. For doing the edges a rabbet plane is an excellent substitute for the cumbersome trying or jointer planes commonly used for the purpose on larger work.

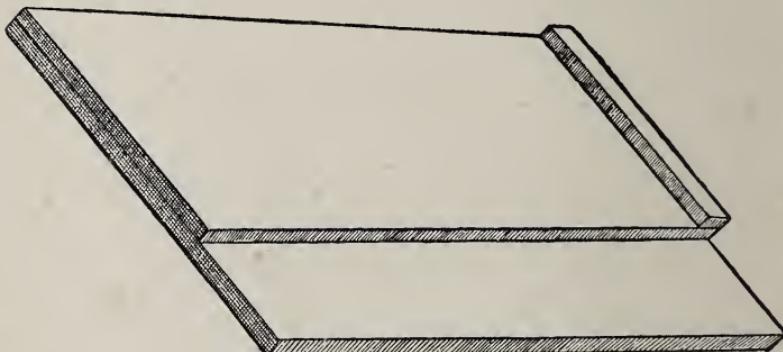


FIG. 12. SHOOTING-BOARD.

Shooting-Board.—This will be found most useful for truing up straight edges and right angles. A simple form, and it is as good as any, is shown in fig. 12. As there represented it consists of a piece of board on which a narrower one is fastened, and across this near one end at right angles with the edge is another piece of wood. It will be seen that by placing the wood of which the edge has to be planed, or technically shot, on the upper board with one end against the transverse piece any part projecting beyond the edge of the upper board can be easily and correctly planed away. To do this the plane, instead of being held upright,

is placed on its side on the lower board and its sole to the edge to be planed. As the cross-piece is at right angles with the guiding edge of the board it will be perceived that there is no great difficulty in planing a piece of wood with perfectly square corners.

Mitre Block.—This is somewhat similar to the ordinary shooting-block just described, in fact it may be regarded as the same thing with the block arranged to shape the wood to an angle of 45 degrees instead of 90. It is principally of use for

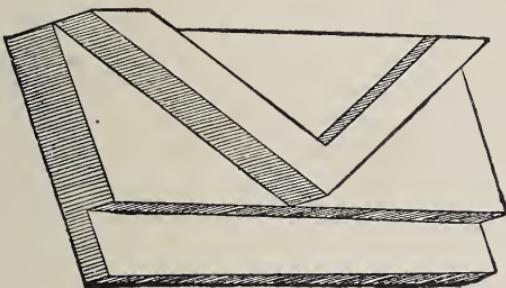


FIG. 13. MITRE BLOCK.

cutting the ends of mouldings to form what is called a mitred joint. For convenience it is usual to have the stop near the centre of the board instead of at one end, and to have it sloping in both directions, as shown in fig. 13.

Square.—As it is of the utmost importance that all work should be put together on the square, this appliance will be found indispensable as a guide to the fitter. It is so well known and its use is so evident that nothing more need be said about it.

Gauge.—This will be found useful not only for marking purposes but for cutting thin wood instead of sawing it. There are two gauges, known as the cutting and the marking gauges, which are very much alike in appearance. It is the former which will be of most use to the fretcutter.

Chisels.—One or two of these will be found necessary. They are seldom required in any but the smallest sizes.

Oilstone.—One of these always comes in handy and is necessary for keeping edge tools in good condition.

Bead-Router or Scratch.—One of these will be found extremely useful for forming mouldings or beadings on the edges of shelves, or elsewhere, and for a variety of similar purposes. With properly shaped cutters ploughing or grooving, rabbetting, as well as small mouldings, either elaborate or plain, may be accomplished.

Gimlets and Bradawls.—One or two of these, in addition to those for boring holes for the saw, will be useful for the purpose of making holes for the screws and nails. They should only be small, as will be more clearly seen from the remark under the heading of nails, etc.

Glue.—Every reader of course knows what this is, and may think he knows all about it. Unless he has had a good deal of experience he probably knows very little about it that will be of much use to him if he wants his glue really good, so that parts stuck together with it will not fall apart on the slightest provocation. Though apparently a trivial matter, the proper selection and preparation of glue is of the utmost importance, so that we make no apology for giving somewhat detailed directions about it. First of all care will have to be exercised in its selection, and by paying a fair price there is never any difficulty in getting it of good quality. The best glue is of a clear brown colour, by no means opaque, nor yet perfectly transparent. Some of the latter is good, but as a rule the very light clear glues are not so strong as the darker tinted, as the bleaching processes tend to weaken them. Sometimes their use is unavoidable, but otherwise they should not be selected in preference to those of darker hue. The best test, however, of glue is in its use, as occasionally a very unpromising looking sample turns out better than could have been expected. As, however, all that the fretcutter uses amounts to very little, he can well afford to buy the best.

To prepare the glue for use it should be broken into small pieces and soaked in cold water till it has become soft or gelatinised. The more water it absorbs without melting, the better the quality of the glue as a rule. If it dissolves in cold water it is poor and weak. It will have become soft in a few hours, after which it is ready to be melted for use. To melt it all, or

nearly all, the surplus water must be poured off, and the remainder put in an ordinary glue-pot. When melted, the glue should run freely from the end of a stick. If it does not, more water must be added to it. As the strength of glue deteriorates each time it is melted, not more than can be used up in a reasonable time should be prepared at once. Some glue sets or hardens more quickly than others, but it by no means follows that because a glue does not set or harden quickly it is defective; on the contrary, it is generally supposed that a quick-setting glue is not so strong as one which takes a comparatively long time. Various nostrums have been published for either increasing the tenacity of glue or for keeping it always ready for use in a liquid state. Of these latter we have only to caution the reader to have nothing to do with them unless a very weak adhesion will suit him. As for increasing the strength of glue, it may be said that this is very seldom necessary, for good glue properly made and freshly mixed and rightly applied is as strong as there is any occasion for. If anything be required to increase its strength, there is nothing better than either a little brickdust or plaster of Paris mixed in.

When using glue, care should be taken that it is not only thoroughly melted, but that it is as hot as it conveniently can be. It is also advisable to warm the parts to which the glue is to be applied. On bringing the parts together, as much as possible of the glue should be squeezed out, and the parts be held in close contact till the glue has set. It is a very common error to suppose that the more of the glue left between two pieces of wood the stronger the joint will be. The reverse is the case. Glue which exudes from the joint can easily be removed any time before it has become hard. It is well not to attempt to clean it off too soon.

As the use of glue requires a brush it may be well to say that a piece of cane hammered out at one end makes a very serviceable one. The hard outer skin should be cut away with a knife from the part to be hammered. If a better brush be preferred it should be a stiff one. For fretwork there is nothing better than a small hoghair brush, as prepared for painting in oil colours.

Glass-Paper.—This is necessary both to smooth the work and to remove dirty marks. For the preliminary papering it may be moderately coarse, but for finishing off only the finer grades should be used. It is sold at all tool dealers and often by iron-mongers at very low prices.

Cork Block.—This is used in connection with the glass-paper just mentioned. It is simply a piece of cork three or four inches long by rather less in width and about one inch thick. The edges on one side are slightly rounded off to prevent the glass-paper being too much torn when it is being used. The paper is folded over the block in any way that may be most convenient to enable it to be rubbed over the wood. The use of glass-paper over a block such as this is necessary to avoid rounding off the sharp edges of fretwork, as they would be if the glass-paper were rubbed on the wood direct with the fingers or without something stiff and flat as a support. A piece of wood instead of cork may be used if preferred, but it is not so good.

Screws.—The sizes required are principally the smaller, and those most generally useful are those known as, 00, 0, 1, 2, and 3, in $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{5}{8}$ inch lengths. In addition to those made of iron a few brass screws, which can be had with either flat or rounded heads, will be useful for fastening on ornamental parts of brass, such as handles, escutcheons, etc. These screws are considerably more expensive, so they should not be used where iron will do as well.

Nails and Needle-Points.—It goes without saying that nails will be as necessary in fretworking as in any other kind of joinery. Those mostly used are of the kind known as wire nails. They are very cheap.

Needle-points, as may be gathered from their name, are sharp pieces of steel very much like needles except that they have no eye. In practice they are extremely useful for many purposes. Being very fine, they may be used where the presence of a nail-head would be objectionable, as they can be broken short off at the wood when driven far enough in. They are thus almost invisible. They are also useful when fitting work together temporarily. They can be got at most tool dealers and, like wire nails, are very cheap. A pennyworth will last a considerable time.

Sundries.—Compasses will be useful for marking circles on the wood, and some kind of a rule can hardly be dispensed with for measuring. The principal tools which are likely to be required have now been mentioned, so that the list is not a very formidable one. It has not been thought necessary to allude to lead pencils, drawing pins, and the multi-

tudinous little odds and ends which may be used. Something should be said about the work-bench or table, which it may be assumed is necessary. No special table is necessary—the work may be done on any which is tolerably rigid. The kitchen-table will do admirably, while the same may be said of the dining-room table, with the additional remark that this need not be injured if only moderate care be taken. For those who can have a room set apart as a workshop it will be a convenience to have a bench with a screw fitted to it in the ordinary way. This will be found a great convenience in making up work.

CHAPTER IV.

MACHINES FOR FRETCUTTERS.

EMACHINE for fretcutting in its primitive form may be regarded as a hand-frame, or as an adaptation thereof, fixed in such a manner that the blade of the saw is kept in a certain definite position to the wood which is being cut. In other words, the saw-frame is guided so that the blade cuts with more regularity perpendicularly than when the frame alone is used.

Machines are actuated either by hand or by foot, or, in the case of the larger kind in trade workshops, by steam. These latter, being beyond the scope of the amateur, need not be further referred to.

Hand Machines.—With these the advantage consists almost entirely in the guidance given to the saw, one hand being at liberty to control the wood and feed it to the blade. With a treadle machine, or one worked by foot, both hands are at liberty to guide the wood, the speed of cutting is increased and, generally, thicker material may be sawn. By a simple contrivance most of the hand machines can be worked by the foot when required, though their power is limited. As the hand machines occupy a sort of intermediate position between the independent hand-frame and the foot or treadle machine, they will be dealt with first. It must be understood that these hand machines are not to be compared with the better kind of treadle machines, nor do they allow of the freedom with which the hand-frame may be worked. Their chief recommendation is that they are inexpensive.

Fig. 14 represents one of the cheapest and simplest forms of hand machines. The frame which holds the saw is hinged at the back to the portion which is fastened to the table or bench by means of a small iron cramp. The small table for supporting the

wood while it is being sawn is of iron, and of course is the counterpart of the cutting-board used with the hand-frame. The downward or cutting movement of the saw is given by depressing the handle and the upward one is aided by the spring.

Just behind the handle there is a small eye, to which a piece of string may be attached for the purpose of working the machine with the foot, which is passed through a loop at the bottom end.

An examination of the hand machine illustrated below will show that the action of the saw is not perfectly vertical or perpendicular to the surfaces of the work, as the frames being hinged at the back naturally cause the front ends of the arms to describe a portion

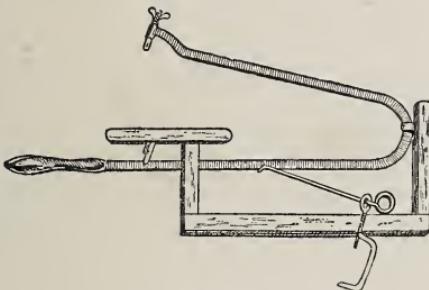


FIG. 14. HAND FRET MACHINE.

of a circle. As the saw-blade gives slightly to the pressure of the wood being sawn, this defect is not so noticeable as might be expected, but a true vertical action is to be preferred. With the ordinary hand-frame, of course, it can be got so that in this respect the hand machine is at a disadvantage.

It should be stated that hand machines have not enjoyed much popularity, at any rate in this country, whether because they have not been sufficiently known or because their advantages are not conspicuous must be left to the opinion of the reader. In most books on the subject they are not mentioned, but to omit any notice of them here would be an injustice to the novice, who naturally wants to know all about everything.

Treadle Machines.—These may now claim attention, and we may take this opportunity of cautioning the novice against the idea that equally good work can be done with all of them.

The first essential of a really useful machine is capacity to do the work it is intended to efficiently. No part of a machine more

conducts to steady action than a heavy wheel, and the sawing powers may almost be considered as depending on this. Any machine will run easily when no wood is being sawn, so the purchaser must not rely on any trial of the action unless he is cutting at the same time.

In selecting a machine the distance from the saw to the back, *i.e.*, the clear space in which material being worked can be swung, must be noticed, and it may also be advisable to consider whether the machine has a presser foot, by means of which the wood can be kept down close to the table and be prevented from being raised by the action of the saw. The wood can be and often is kept down by the hands, but if through inadvertence the pressure is released while the machine is in motion the wood is jerked up and the saw is probably broken. By the use of the presser foot this risk is lessened and the hands are left entirely free to guide the wood.

To give the novice a fair idea of the machines most commonly met with, the principal ones are briefly described. For convenience' sake they may be divided into two classes, viz., those with true perpendicular action, and those in which the saw, though sufficiently so for ordinary purposes, is not always perfectly vertical. In the former the saw can only move up and down in the same direct line. In the latter the saw is fastened to clamps at the ends of movable wooden arms, so that as these move the position of the saw varies to a small extent. In the cheaper class, that with movable arms, the tension of the saw is equal at all parts of the stroke. The cutting-edge can only be made to face in two directions, *i.e.*, backwards and forwards. In machines with the perpendicular action when a spring is used the tension of the saw varies, though to a practically imperceptible extent; it is naturally greatest when the saw is at the end of the downward stroke and least at the end of the return one. The direction in which the saw faces can be varied so that long wood can be cut. It is not possible to remove the arms, as is occasionally a convenience when threading the saw into the centre of a very large piece of work, but still for all-round work we are inclined to prefer that with perpendicular action.

The Cricket machine is chiefly noticeable on account of its low price, which is about 13s. It is only capable of light work, but so far as it goes it is not to be despised. It has a tilting table, but no blower nor drilling attachment. The clearance is 16in. It is shown in fig. 15. The "Improved Rogers" is a very similar

machine, but is somewhat heavier and therefore capable of doing heavier work. It has a blower and drill attachment. Clearance 18in. from saw to back. Price 16s.

The "Lester Improved" is a good machine on very similar lines, but is very much heavier, being about double the weight of the Rogers or 50lbs. In addition to blower and drilling spindle, it has an emery wheel, lathe, and circular saw attachments. For sawing the clearance is 18in. The circular saw attachment consists of an iron table $4\frac{1}{2}$ in. \times 3in., the saw itself being $2\frac{1}{2}$ in. diameter. Naturally the cutting powers are not great. The lathe attachment is easily adjusted and is useful for doing small turning.

Of machines known as the "Dexter" there are three varieties, distinguished as A, B, & C, of which the latter, illustrated in fig. 16, is the best for general purposes. The drilling attachment is unusually convenient. The weight of the machine is rather less than that of the Lester, but excellent work may be done with it. The clearance is rather under 17in. The B. Dexter is similar, the principal difference being that it is lighter, the table does not tilt, and the clearance is $12\frac{1}{2}$ in. The A machine has the same distance to the back as the B. It is made to fasten to a table or bench top. Neither the A nor the B patterns are often to be met with.

The "Rival," illustrated in fig. 17, is provided with a lathe. The machine is well adapted for sawing small work, its weight being less than that of the Lester and the swing of the arms is $16\frac{1}{2}$ in. It has an upright drilling arrangement, like the Dexter.

The foregoing are the principal machines which the amateur is likely to meet with having movable arms. There are several more, but they are principally of larger size and may be considered as trade workshop tools for doing heavy cutting with.

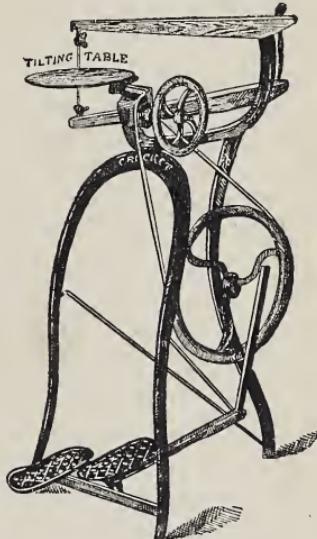


FIG. 15. THE CRICKET TREADLE MACHINE.

The other class of machines, viz., those with perpendicular action of saw, may now receive an equal amount of attention.

The "Challenge" machine is shown in fig. 18. As will be seen, it has all the features of a first-class machine, tilting table, upright drill, and good blower.

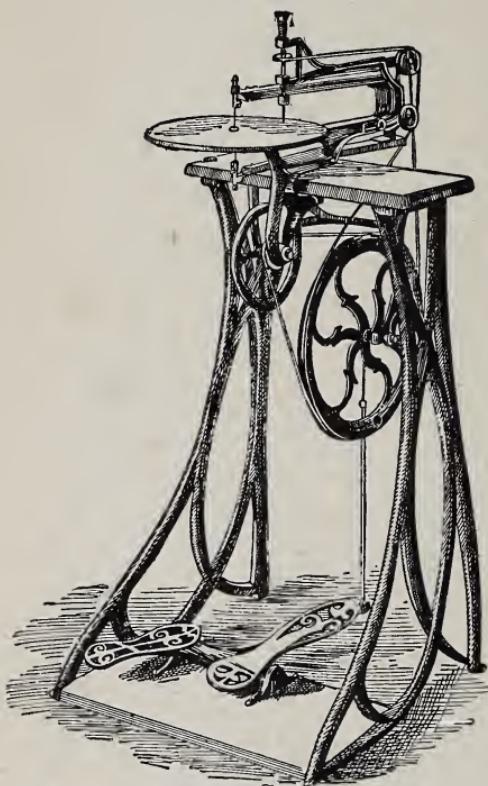
The swing under arm is, however, only fifteen inches, so that the space is comparatively limited. It is a good heavy machine and stands firmly. There is also a lathe attachment, which can be had separately. The upward stroke of the upper saw-clamp is caused by a bent spring.

The "Fleetwood" is rather an ornate-looking machine, and is as good a one as can be met with, but rather expensive.

The "Britannia No. 7" is an English-made machine and is represented at fig. 19. Being made in England by the well-known Britannia Company, it pos-

FIG. 16. THE DEXTER TREADLE MACHINE.

sesses an advantage in having the manufacturers close at hand in the event of any repair being required. The table is much larger than usual, as it extends the whole length under the arm, so that ample support is given to large and fragile work while being cut. A loose piece affords easy access to the lower saw-clamp. The distance to saw from arm is twenty inches, so that large pieces can be worked on. The drill shaft, which is not visible in the illustration, is horizontal,



and will hold emery or buff wheels, or polishing brushes. The presser foot and blower are both good, and, of course, the table, as in the case of every good machine, can be fixed at any angle for cutting on the bevel. The upward stroke of the saw is assisted by a spiral spring.

The "Britannia Co.'s No. 8" is in every respect an admirable machine, and possesses advantages which are not found in any other. It bears a strong resemblance to the machine last mentioned, but has several important alterations. Apart from those features which it possesses in common with the No. 7, its chief characteristics are the heavy fly-wheel and the method by which the tension of the saw is secured.

The unusual weight of the wheel is an important factor in ensuring that steadiness of action which is so great a comfort to the worker and so essential to accurate cutting. The wheel is grooved for two speeds, so that metal sawing or heavy work which would be almost impossible on any other machine of similar size can be done with comparative ease. Though the machine is stated by the manufacturers to cut wood $\frac{5}{8}$ in. thick easily, there is no great difficulty with a suitable saw in working 1 in. oak, by using the slow-speed groove, while either with this or the other one thin stuff may be cut with the greatest ease and accuracy.

The equal tension of the saw at all parts of the stroke is

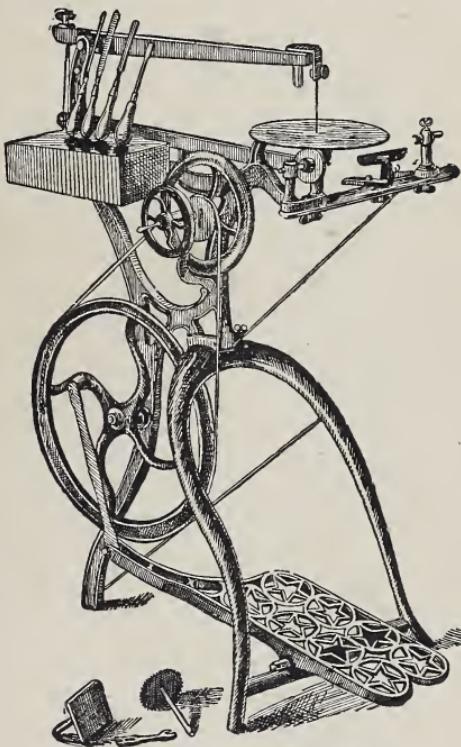


FIG. 17. THE RIVAL TREADLE MACHINE.

maintained by a very simple and ingenious arrangement of wooden arms, which dispense with any need for the somewhat objectionable spring which is usually an accompaniment of perpendicular action. The tension can instantly be adjusted to a nicety, or altered as may be required. The "Improved No. 8," as its name implies, is merely a modified form of the other, in which several minor details have been altered. Although they are only small,

they are by no means unimportant to those who can appreciate them. The chief alteration is the addition of an upright drilling arrangement similar in principle to that of the "Dexter" and "Challenge" machines. The construction of the saw-clamps has also been slightly altered.

We have now described the leading features of the best-known machines in the market in order that everyone may be enabled to select for himself. Whichever machine the fretcutter decides on, a few general hints as to its treatment and care will not be amiss, though to those who are accustomed to machinery, either large or small, they may to a great extent be superfluous. The fitting together of the various parts

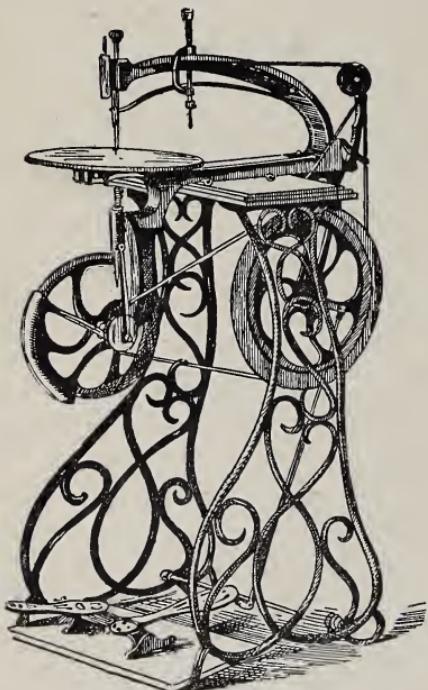


FIG. 18. THE CHALLENGE TREADLE MACHINE.

will first engage the attention of the purchaser, unless indeed it is got from a local dealer, who may possibly deliver it fitted up. If sent by rail it will arrive in separate pieces for convenience in packing. To give details for fitting up each machine is of course out of the question, and all that can be done is to recommend the fitter to consider each portion well before attempting to fit up. As a rule there is no difficulty if a little care and judgment be

exercised. Perhaps the most important piece of advice is that no undue straining should be exercised to put the parts together. If any great strength is required to get them to fit, it shows that there is either something wrong with the pieces themselves, or, what is

much more likely, that the fitter is trying to make the machine up wrongly. All nuts and screws should be tightly fitted, so that the machine may be as rigid as possible. All the working or frictional points should be well oiled, and where they are of wood a mixture of soft soap and blacklead or blacklead alone will be better than oil. When the saw is fitted, notice whether the clamps are fixed so that the saw is straight and not twisted, and that it cuts directly to the front. If it does not, a little adjustment will be necessary. It will also be advisable to be careful that the table is fixed horizontally, so that the saw cuts square with the wood, that is, of course,

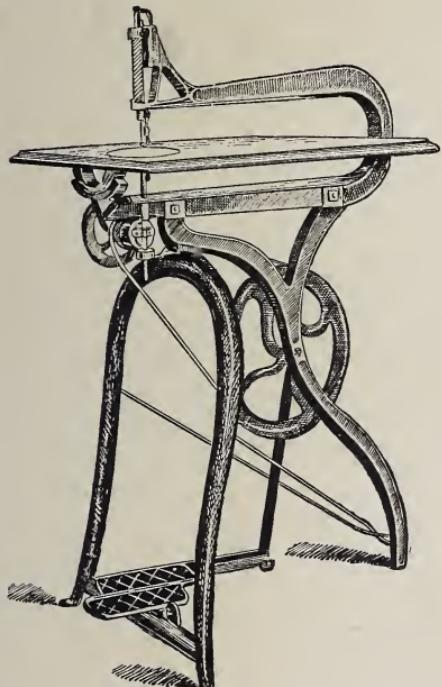


FIG 19. THE BRITANNIA, NO. 7 TREADLE MACHINE.

assuming that the learner will not at first want to cut on the bevel. It has been said that all screws must be fitted up tightly, but naturally when they are pivots, as in the case of those on which the wooden arms of the Lester swing, discretion must be used. Some attention will be requisite when adjusting swinging arms, for if they be too tight there will be unnecessary labour in working the machine, and if too loose there will be a sideplay which is neither comfortable nor conducive to good work. After a time the leather cord will probably have stretched and become loose, so that it slips in the

grooves, a little must then be cut off one end in order to shorten it; but if made too tight there will be an unnecessary amount of friction. When once it is properly adjusted a good machine requires very little attention beyond oiling.

Perhaps it is expected that something should be said about the cutting capacity of machines, as the question as to the thickness of the wood that can be sawn with any particular machine is often asked. Unfortunately for such inquirers it is not possible to give definite answers, but to give some idea of what may be managed, it may be said that few machines can be worked with comfort if the wood is over $\frac{1}{2}$ in. thick, although with some of them it is not impossible to saw through even oak of double that thickness. It is rarely that the amateur will have occasion to use wood of more than $\frac{1}{2}$ in. thick. Those who want to do really fine inlaid work will do well to select a machine with vertical stroke of saw and with a good and easily-adjusted presser foot, as otherwise it is difficult to prevent fine pieces of veneer from breaking. The machine for this kind of work should be one of the best.

CHAPTER V.

HOME-MADE TOOLS AND APPLIANCES.

THIS is not to be understood that the various things which the worker can make for his own use are not to be bought, for everything the fretcutter requires may be bought ready for use. There are, however, many who like to make as much as they can for themselves, and for these the instructions given may be useful, as the tools, etc., described are of the simplest construction, so that anyone possessing a moderate amount of skill can make them.

Saw-Frames.—Naturally the saw-frame must first engage attention, and the form about to be described, and which is illustrated in fig. 3 page 9., is of exactly the same kind as is used by practical marquetry-cutters. It may therefore be regarded as being the best in use.

The saw-clamps, fig. 20, will have to be bought, as there are few amateurs who could make them or would care to do so. Assuming

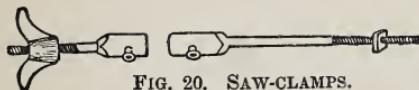


FIG. 20. SAW-CLAMPS.

that a pair of these have been got, the frame may be made as follows. The material will be beech, or any strong wood which is not too heavy, $\frac{1}{4}$ in. thick. Of this for a 12in. size the following pieces will be required, two of them 13in. long and one of them $8\frac{1}{2}$ in. They should be 1in. wide, though if other proportions are altered accordingly these measurements need not be closely adhered to. The chief thing to be remembered is that the distance between

the two jaws is somewhat less than the length of the saw-blades. If $4\frac{1}{2}$ in. be allowed clear it will do very well. The three pieces of the frame are fastened together at the back by a halved joint which should be neatly formed and glued. In each angle, as a stay, glue pieces shaped as shown in fig. 21. These must be trimmed to exactly the thickness of the wood against which they abut. Now, on each side of the frame at each of the corners glue thin (say, $\frac{1}{8}$ in.) stuff, covering pieces shaped out to correspond with the braces. The outer corners should be neatly rounded off for the sake of appearance as well as for convenience. A joint so made should be as strong as there can be any reasonable occasion for, but if considered advisable a few screws or fine nails run through will do no harm. So much for the frame itself, but there is still the handle and its fitting. This will probably be a more difficult job. For the top end to hold the smaller jaw a piece of sound beech, or other suitable wood, $1\frac{1}{4}$ in. long and the same in diameter, will be required.

As it may not be convenient to turn it, there is no absolute necessity for it to be round. If octagonal, that is square with the corners taken off, it will be just as useful for all practical purposes, but it will not look so nice. Through the centre of this in the direction of its length a hole is to be made to pass the

FIG. 21. SAW-FRAME STAYS.



frame itself, but there is still the handle and its fitting. This will probably be a more difficult job. For the top end to hold the smaller jaw a piece of sound beech, or other suitable wood, $1\frac{1}{4}$ in. long and the same in diameter, will be required.

As it may not be convenient to turn it, there is no absolute necessity for it to be round. If octagonal, that is square with the corners taken off, it will be just as useful for all practical purposes, but it will not look so nice. Through the centre of this in the direction of its length a hole is to be made to pass the



FIG. 22. HANDLE OF SAW-FRAME.

screw and receive the square portion of the shank of the jaw as far as the part where it is widened out. A mortise must next be made in one side of this little block to receive the tenon to which the end of the frame is cut. Do not reduce the thickness of the frame more than can be helped, and let the tenon be as large as it can conveniently be. The joint will be secured with glue.

The handle itself is a rather more complicated piece of work, but fig. 22. will assist in making all clear. On the jaw which is used in this part of the frame there is a small loose nut on the screw. This nut may be left alone for the present, but it will help

those who are not acquainted with the construction of a fretsaw handle to understand better what is wanted. As shown in the illustration, the handle is in two portions. The longer one is attached to the frame in the way described for the end, for the other jaw and the iron runs through it. Now, if the nut referred to be in the other part of the handle, as it is represented to be in the illustration, and a hole large enough for the screw to be bored in the length of the wood, it will at once be seen that the jaw may be screwed tightly to the handle. A hole through the smaller piece of wood might do without the nut, but there would be very little durability. It will be seen that the hole in the part of the handle where the frame is fastened on is only large enough to pass the square part of the iron, and that the remainder of it is bored to receive the thinner portion of the other part of the handle. This is bored to take the screw, which it will be noted may fit quite loosely within it. The nut is inserted by cutting a hole through from side to side. It will be convenient if the nut fits tightly. A handle about 6in. in length will do very well. Those who have a steel or iron frame with movable jaws may easily make a wooden frame, as the handle they already have will obviate any necessity for a new one being made. All they will have to do will be to make the frame and fasten the handle into a larger hole in the block at the bottom than in the top one. If the wood in this block is to be of sufficient substance to hold the part of the handle which in the iron frame is covered with the metal, it will look very clumsy.

In some wooden frames the blocks are not fastened on, but form parts of the top and bottom of the frame. It is claimed for these that they are stronger than those described, but as these are strong enough and have the additional advantage of being more easily repaired, there is no adequate advantage to compensate for the extra trouble of making, and consequently increased cost. Fig. 23 will show how the wood is tapered off from the block to the normal thickness of the frame.

The cabinet-maker's bow-saw frame, illustrated in fig. 5, p. 10, is one which can be made at home, and may with advantage be added to the outfit if there is any thick wood to be shaped. The shaping of the jaws may be omitted. The saw-clamps or jaws may be bought

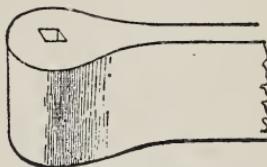


FIG. 23. SHAPE OF WOOD
OF SAW-FRAME.

with the handles at any ordinary tool shop, or they may be made at home, as they are very simple. Both handles being alike, it will be sufficient to describe one of them. The handle may be of any convenient shape and length that can be grasped comfortably. Into the end of it is screwed a piece of iron or brass rod of about $\frac{1}{4}$ in. diameter. A screw nail may be used, its head being cut off afterwards. A saw cut extending, say, $\frac{1}{2}$ in. will have to be made from the end into which to insert the saw-blade when in use. These blades are either kept in place by a small rivet or piece of wire. The simplest way of doing is to drill a hole through the metal at a right angle with the cut. A piece of wire run through this and the hole in the end of the saw-blade is then all that is required. Fig. 24 shows this part of the work clearly. The thin straight part of the handle goes through a hole in the frame and

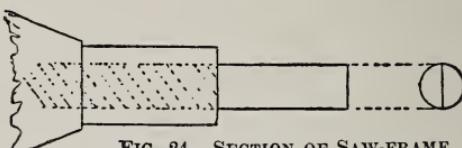


FIG. 24. SECTION OF SAW-FRAME HANDLE.

has a thin piece of brass tubing round it to prevent it from splitting. As these handles can be turned in any direction without loosening the blade, the frame need not be a large one from back to front. The blades are made from 8 in. to 16 in. in length. One of 10 in. is a convenient length. The total length of the arms may appropriately be from 10 in. to 1 ft. They may be made of wood 1 in. thick and at the widest part some 1½ in. wide. The broad piece connecting—or rather, should be said, separating—these two will be in length to correspond with the length of the blade, about 1 in. wide, and either of the same or slighter substance. At both ends it is sunk into a corresponding mortise in the other portions of the frame, but the fitting must be dry, *i.e.*, without glue and loose. At the other ends of the arms from the saw string is wound round and tightened to the required degree by the small piece of wood which engages with the piece last referred to and so prevents the cord from unwinding.

To use the bow-saw the wood must be securely fastened to the bench, as one hand is required for each handle. Naturally the fretcutter will not use this tool when he can use something lighter.

Cutting-Board.—This certainly can be made at home, indeed it hardly requires making, for it need be nothing but a piece of plain board. For convenience, however, it usually has a triangular piece cut out, as was stated in Chapter II. This, however, may for some purposes be improved on. The particular shape and size are matters of comparative importance, but the arrangement is so simple that there is no reason why the cutter should not have several boards by him, so that he can select that which is most suitable for the work in hand. As the object of the board is merely to support the wood while it is being cut, thick stuff can be worked without risk of breakage on a board with a large opening. Fine delicate work, on the contrary, must be supported as much as possible, so that the opening for the blade should not be larger than is necessary. With these general principles to guide him, the beginner can have little difficulty in adapting his cutting-board according to circumstances. The opening is generally of a V shape, and it stands to reason that the inner angle should be acute, or the amount cut away may be so great that there is an inadequate support afforded. For a board of general utility there is nothing better than an opening shaped like a V with the V part terminating in a narrow passage for the saw-blade, while for greater freedom in working this there is a small circle bored out with the centre bit or other convenient tool. Large work can be cut over the V opening. It may sometimes be an advantage to use a board with a simple passage for the saw to a hole for it to work in. It will be found that it is much easier to work with a large opening than with a small one, as the saw in this is apt to catch in the cutting-board. At the outset it is not necessary to have a board with a small opening, as the beginner will not do fine work.

The size of the board should be as great as the saw-frame will allow, that is, it must be possible for the frame to swing clear of the front corners. As a rule cutting-boards are much smaller than the outside limit at which they might be used, but the larger they are the smaller the risk of the fretwork being broken while it is being sawn. On the other hand, if the board is too large it is apt to be unwieldy. For general purposes, perhaps, a board measuring 12in. by 8in. is as convenient as any, and it will do to make a start with.

In order to fasten the board to the table, one or two cramps of the kind shown in fig. 25 will be required. They are easily obtainable, and as a rule one will suffice. In the board, somewhere

near the centre, though nearer the back than the front, bore a hole large enough to let the top of the cramp, *i.e.*, the end opposite to the screw, pass through it easily. The board might now be fastened to the table, but the upper arm of the cramp being above the surface would be in the way of the wood to be operated on, and this would never do. It is therefore necessary to cut a hollow

place in the board for this upper arm to lie in, so that it is below the surface and out of the way. If one cramp is not found to hold securely, then two must be used, the holes for them being bored not in the centre but near the edges.



FIG. 25. CRAMP.

Shooting-Board.—This has already been referred to so fully that it is unnecessary to say much more about it. A few detailed directions will suffice. The total length may be from 12in. to 18in., and the width about 6in. These are suitable, but any others may be taken if preferred. As an illustration has been given in fig. 12 it may be advisable to refer to it. On the top of the bottom board, which may be 1in. thick, another of about 4in. in width and $\frac{1}{2}$ in. in thickness is screwed or glued. Its front edge, *i.e.*, the one which is set back on the lower board, is to be perfectly straight and square. On one end a piece of wood is screwed so that it is at exactly a right angle with the edge of the piece last referred to.

The block for shooting mitres is on exactly the same principle, the principal difference being that instead of the stop being at a right angle, it is at one of 45 degrees, and for convenience there are two of them. Any angles can be shot perfectly true either by making shooting-blocks specially, or in a simpler manner by having pieces of wood cut at the desired angles, to put temporarily between the fixed stop and the wood being shot or planed.

Scratch or Router.—This is, considering its simplicity, one of the most useful tools which the fretcutter can have. Besides its convenience for cutting beads and mouldings on the edges of shelves, etc., its possession renders the worker almost independent of ready-made ornamental mouldings, which form such an important feature of many fretwork articles. The tool itself consists of a wooden stock or handle, to which variously shaped cutting-irons can be made and fitted at pleasure. It is

little more than a modification of the ordinary marking or cutting gauges. It is shown in fig. 26. The cutting-iron is movable, and the head or stop is part of the handle. This is formed of two

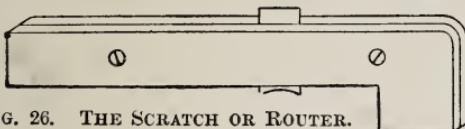


FIG. 26. THE SCRATCH OR ROUTER.

pieces of any hard wood about 1 ft. long, $\frac{1}{4}$ or $\frac{3}{8}$ in. thick, and $1\frac{1}{4}$ in. wide at the butt end. These are shaped as shown, and are kept together by two or more screws, the cutting-irons being thereby secured between them.

By loosening the screws the irons can be altered or moved as required. If a screw is in the way, it is a very simple matter to bore fresh holes. The preparation of the stock requires no special care, but the irons must be carefully prepared, as the appearance and regularity of the mouldings depends almost entirely on them.

As the action of the tool is entirely a scraping and not a cutting one, its chief utility is for small work, for to shape large mouldings or members of mouldings would be more trouble than the labour is worth; but it must not be forgotten that even a large moulding may consist of only small members, and that by using a series of irons much good work may be done.

For the irons, pieces of steel about the thickness of the scraper, which has already been alluded to in the chapter on tools, will do very well. Perhaps the best way of explaining to the novice what is wanted will be to suppose

FIG. 28. that a series of three beads is to be worked on the edge of a board, as shown in fig. 27. The iron to scratch this will be shaped at the cutting end as in fig. 28, which it will be noted is just the negative or reverse of the bead. The end of the iron may, if preferred, be shaped so that the three rows of beads are scratched at the same time. As a matter of fact, they would seldom be cut separately if not much larger than represented, and an iron might at least be preferred to cut two of them at the same time. Whatever the number, it is only necessary after cutting one bead to move the iron into position for cutting the next one to it. It will thus be



FIG. 27.

seen that a series of beads and hollows of different shapes can be made by having suitable irons.

The scratch is used by holding it in both hands, keeping the inner side of the butt end against the edge of the wood to be moulded, and the cutting edge on its surface. It is then moved backwards and forwards till the iron refuses to bite. Only moderate pressure should be used, and the butt must be kept firmly in contact with the edge of the wood, which must be secured to the bench or table top. Not only straight, but round or curved mouldings may be worked with this simple tool.

Perhaps some direction should be given about preparing the irons, though after what has been said this is such a simple matter that it seems almost unnecessary to do so. The metal should, if possible, be held in a vice, and of course files are necessary to do the shaping. The filing should be straight across, so that the edges of the metal are square; if they are rounded the scraping powers of the tool will be very limited. Sharpening otherwise than this is hardly necessary, though some people prefer to give the edges a final rub either with a scraper sharpener or with slips of sharpening stones similar to those used by carvers.

It is advisable to mark the outline to be filed down to, and as it is not altogether an easy matter to mark it on the steel direct, it will be better to glue a piece of paper and mark the outline on it. It may sometimes be a convenience to be able to soften the iron before filing, and naturally this implies that it must be hardened afterwards. The former may be managed by heating to a dull red and letting it cool slowly in the ashes, while the latter can be done by reheating and plunging into water. Great nicety of temper is not wanted, and the iron will be ready for use. Beads and mouldings worked by the scratch are generally the better for being touched up with glass-paper. In using this, care should be taken not to rub so roughly or so freely as to take the character out of the mouldings, which should be left sharp and clean. The paper can be held over thin slips of wood, shaped to correspond with the beadings, etc.

CHAPTER VI.

MATERIALS.

THE principal material used by the fretcutter is wood, and he should attain skill in cutting this before using others either more difficult to work or more costly. Among the other materials may be mentioned brass, and the softer metals, mother of pearl, vulcanite, xylonite, ivory, etc. Wood is the material for which most of the published designs are prepared. There is ample scope in this one material alone. He can choose wood nearly white, or, if he prefers it, black, for ebony is nearly so if not quite, or he can have wood dyed in a variety of colours. A few of the chief characteristics of the various kinds of timber most commonly used will be useful, as well as a few hints about buying wood, and the way in which it is specially prepared for the fretcutter.

Wood may be bought at the ordinary timber yards, but many of the fancy varieties are not always to be met with in this manner and it is rarely to be got of suitable thickness. Generally the timber merchant does not care to cut a board, so that the purchaser is compelled to take more than he requires. Naturally the prices at the timber yard are less than those quoted by dealers who will cut any size required. To do this means waste, for which the dealer must be recouped. Those who buy in large quantities will find that a considerable saving is to be effected by going to a timber yard for what they want. On the other hand, they will seldom be able to get the wood planed smooth at a timber yard, as it will be rough from the saw. This, however, is not a very serious objection, as if the fretcutter does not care to do this work himself he can get it done for him by any cabinet-maker. When purchasing wood it is necessary to be careful to select well-seasoned dry stuff, and if it is got from an open timber yard it is very likely not to be dry, although it may be thoroughly seasoned. Timber should

be kept in a warm dry room for a time before it is used, but on no account should any attempt be made to hasten the drying by placing it too near a fire. If this is done the wood is very apt to shrink, split, or twist. As it is not an easy matter to judge whether wood is seasoned or not, although there are certain signs by which an expert can generally tell, the best plan for the amateur is to deal only with a reliable merchant to whom the selection may be left. Wood specially prepared and sold by dealers in fretwork materials may almost invariably be depended on for being dry and well seasoned.

Boards are not always so flat as they ought to be. When a board is really badly twisted it will seldom be of much use wasting time over it, as it rarely happens that any improvement can be effected except by planing it down, and in the case of thin boards there is not enough stuff to allow of this being done. It often happens that a board has become rounded or convex on the one side and concave on the other. In this case it is often possible to flatten the wood without much trouble. Wood on being damped swells, consequently if wetted on one side that becomes convex and the other correspondingly concave, or to use the more usual workshop term, it is rounded on the one side and hollowed on the other. If the hollowed side be equally damped it will in its turn swell, so that the board again becomes flat, and if both sides are dried equally it will remain so in all probability. In practice it is not a good plan to damp wood more than can be helped, so the hollow side is rarely wetted, but the converse plan of drying the rounded side is adopted. This may be managed by placing it for a short time near the fire, but not too near or it may split or curl the reverse way. It is impossible to give precise directions, as so much depends on circumstances. Occasionally it may even be preferable to swell the hollow side by damping it, and very little moisture is required to effect what is necessary. Where there is plenty of sawdust about it is not an uncommon plan to moisten a few handfuls of this and to let it lie on the hollow side of the wood for a few hours. Boards may often be flattened by simply laying them down on a cold floor with the hollow side downwards, or by placing them against a wall. In every case the principle of swelling the hollow side or shrinking the rounded one is the basis on which boards are treated, unless it is necessary to plane them down.

Wood in such quantities as the amateur is likely to require is sold by the square foot, except a few varieties which are generally sold by weight. Wood being sold and quoted for per square foot

may mislead the novice by inducing him to suppose that if he orders a foot or any number of feet he will get a piece one or several feet square. The superficial measurement is taken in calculating the number of feet the board contains, thus a board 2ft. long by 6in. wide is only 1ft., the same as one measuring, 12in. by 12in. When ordering wood, more than the actual quantity apparently required must be got, as it is impossible to work it up without some waste. The amount of this depends on the job, and the cutter will soon learn to estimate it with a sufficient amount of accuracy. If more is got than is required for a special article, the odd pieces which are left over will very likely come in handy for making up some small thing, so unless very small they should not be thrown away.

The wood that is specially prepared for fretworkers is generally in certain definite thicknesses, and these are $\frac{1}{8}$, $\frac{1}{4}$, and $\frac{3}{4}$ in. In addition to solid wood in these thicknesses, what is known as 3-ply wood is also prepared, each board being made up of three veneers with the grain of the middle one in the contrary direction to that of the outsides. From this arrangement the 3-ply boards are less likely to twist or split than when in the natural state. They are also much stronger, and on that account are to be preferred to solid wood for fine, delicate work. The 3-ply is not obtainable in greater thickness than $\frac{1}{4}$ in. It is always sold planed and finished, ready for use.

While speaking of the thickness of wood, it is usual to speak of wood by its nominal thickness. This remark hardly applies to specially prepared fretwood, which is often sold at its actual thickness. When wood is got from the ordinary timber yard, the purchaser should be careful to explain whether the thickness he wants is the nominal one or the thickness "down," which means after the wood has been finished smooth by planing "down." The reason for boards not being of their nominal thickness may be explained in a few words. If an inch board, that is, one an inch thick, is divided into four, each piece is nominally $\frac{1}{4}$ in. thick. Actually these boards are less, as the saw cuts or kerfs have removed some of the wood in the form of sawdust. The wood being rough from the saw is further reduced in thickness by smoothing.

Wood is also sold in the form of veneers, which are very thin, so that they cannot be used by themselves, but have to be stuck on to a solid foundation or ground. Veneered fretwork is generally used in the form of inlays or overlays, both of which will be

explained in due course. To the marquetry-cutter they are essential, as all marquetry is done with them. Veneers are prepared in two different ways, known as knife-cut and saw-cut. The former is very thin, though cheaper it is not so suitable for the kind of work under consideration. It is merely mentioned to put the purchaser in a position to know what kind of veneer to get. The ordinary saw-cut veneer is in every way better for working with. The value of most kinds of wood varies according to the choiceness and variety of its figure or markings. Some woods, however, such as holly, depend a great deal more on their purity of colour and absence of figure. These, however, are the exceptions.

Although any kind of wood may be used by the fretcutter, certain of them are more likely to be met with than others, and a short description of the principal will be useful. Only those which can be easily obtained, either from an ordinary timber dealer or from fretwork specialists, are mentioned. Many of them, being used in the construction of ordinary articles of furniture, can be obtained at a cabinet-maker's if there is no timber yard available.

Ash.—Coarse in grain, with large figure, without much variety. Hard and tough. The colour varies from a light yellow to a light brown. The Hungarian variety is very different from the ordinary, being full of figure and of a different colour. It is generally used in the form of veneers and is not a pleasant wood to cut.

Beech.—A fine, close-grained, hard wood, mostly of a light reddish-brown colour, though some of it is nearly white. It is a nice clean-cutting wood, and polishes well either in its own natural colour or stained.

Birch.—A similar wood, but with a much finer figure in the choicer varieties.

Cedar.—The ordinary variety is the material of which cigar boxes are generally made, and may often be confounded by the novice with mahogany, which it to a certain extent resembles. It is coarse in the grain, without much figure, and moderately soft. It must not be mistaken for the fragrant variety known as pencil cedar. This is a very soft silky wood without much figure, close grained, and pleasant to work, but is easily split.

Canary.—This, as generally sold for fret purposes, is a soft American wood often simply called whitewood, but of a yellowish tinge. It is remarkably free from knots and there is practically no figure. It cuts well and easily.

Cherry.—Close grained, hard, light reddish-brown in colour, and very suitable for fine work.

Chestnut.—There are two distinct varieties, one of them being the timber of the Spanish or eating chestnut tree, and the other of the horse-chestnut tree. The former bears a great similarity to oak. It works well and freely. The wood of the horse-chestnut has very little figure, is close and soft, and is of a light colour, much of it being almost white. On this account it is often useful as a substitute for holly.

Ebony.—Ebony wood dyed black is generally used instead of real ebony, which is not a pleasant wood to cut, being very hard and troublesome in other respects. Very little ebony is absolutely black.

Holly.—This wood, as prepared for the fretcutter, is chiefly American, and is of a beautiful creamy white, closely resembling ivory. It is hard and close grained, with little figure. This latter feature along with its colour are the characteristics which render it of value to the fretcutter. White chestnut, or the finer kinds of sycamore, may be used as substitutes. It should not be polished or varnished, as treatment of this kind destroys the purity of its colour. This being so delicate is apt to become dirty when handled during working, but may be restored by rubbing on a little whiting with a soft rag or cloth.

Lime.—Light coloured and in general features resembles holly, but is softer and not so white. American lime tree is often called bass or American whitewood, and under this name can be obtained at many timber yards. It is very clean and free from knots.

Maple.—A light yellowish-brown wood, hard and close grained, without much figure in the plain kind. “Bird’s Eye” maple, on the contrary, is distinguished by the richness of its figuring. It owes its name to the peculiar configuration of the small knots which form the centres of the markings. It is generally used in the form of veneers; it is not a pleasant or easy wood to cut with the fretsaw.

Mahogany.—This wood is too well known to need much description. It is an admirable material for the fretcutter or any worker in wood, as it cuts well and cleanly, is susceptible of a very high degree of finish, and in the choicer sorts is beautifully marked. These, on account of their value, are principally used in veneers. There is probably no wood in which so much variety is found as in this, and there is a corresponding range in the prices charged for it. The plainest and softest is Honduras mahogany, frequently called baywood. Some of it is fairly well figured, but as a rule it is plain and of only a moderate hardness. It is very suitable for general use, either for fretting in the solid, or as a foundation on which to lay the more choicely figured veneers. Spanish mahogany is harder and of better figure. The term "Spanish" is of very wide application, and if some other kind which may not be strictly Spanish is equally as good in figure the exact place of growth is not a matter of importance.

Oak.—Though hard, this is by no means an unpleasant wood to work, and for many articles is to be preferred to any other. There are many varieties. Without detailing these, it may be sufficient to say that American oak as a rule is the plainest, while the better kinds are known as Dantzig, Riga, wainscot, etc. In colour oak inclines from a light yellow, almost white, to a dark brown, and is generally distinguished by dealers in fretwork woods simply as light or brown. The finely figured variety, known as pollard oak, is not suitable for using except as veneers. As oak is a wood that can easily be stained to a darker tint than the natural one, like coloured wood it is more useful than the brown. Light oak, being very easily darkened by ammoniacal vapours, should not be kept in a stable or where it is subject to such fumes. This tendency in oak is taken advantage of to darken it by what is called fumigation, a most useful process as the wood is not roughened as it is when a liquid stain is applied.

Olive.—Of a light yellow-brown colour, finely variegated with darker markings, is hard, fine in grain, easily worked, and takes a good polish.

Pine.—Though looked upon as a common wood, there is no reason why it should not be more largely employed than it is by the fretworker, for it is by no means without a beauty of its own, while it is both easy to work and inexpensive. As there are many

varieties of pine, it may be well to say that common spruce which is full of knots is not so suitable as the yellow or red pine, which can often be obtained in nice, straight-grained, clean pieces. If left "in the white" or unpolished it looks very well, and by becoming darker improves in appearance with age.

Pitch Pine.—Pitch pine is a distinct variety, much harder and more decidedly figured than the ordinary kinds. As it contains a large quantity of resin it is not a pleasant wood to cut.

Rosewood.—Like the last and for the same reasons this is also somewhat difficult to saw, especially as it is hard and close in texture. In colour it varies from a dark red to brown with strongly marked darker figuring. Genuine rosewood is fragrant, but this characteristic is absent in many varieties, almost exactly the same in appearance, which have found their way into the market. If used for its smell the wood should preferably be left unpolished.

Sycamore.—A very clean, nice-working wood, tolerably hard, and varying in colour from almost pure white to a dirty brown tinge. It is close in grain, and when white is an excellent substitute for holly.

Satinwood.—This is a beautiful yellow wood, often finely figured with smooth lustrous markings after the style of choice mahogany, which it resembles except in colour. It has an agreeable odour, and though hard is pleasant to work.

Sequoia or Californian Red Pine.—This is the softest wood known, but it is not altogether a satisfactory one, as it easily splits, so that it is quite unsuitable for fine delicate work. In appearance it is not unlike pencil cedar, but has none of its fragrance. As a substitute for pine it may be used for drawer sides, etc., the backs of cupboards, and inside work generally. Its chief advantages are that it is very straight in the grain and free from knots. Being soft and cheap, it is a good wood for the beginner to practise with.

Walnut.—Black or American walnut is the most suitable for the fretcutter. It is hard but pleasant to work in, being generally free from knots and evenly grained. The beautifully figured variety known as burr or Italian walnutt is used only as veneers.

Yew.—Yew is a finely marked, close grained wood, in colour varying from a pale yellowish orange to a reddish tint with dark small markings or knots almost black in colour. It is tough and hard and cuts cleanly.

This list by no means exhausts the kinds of wood that may be used or met with, and it might be almost indefinitely extended by naming those which are of comparative rarity or not so generally used by the fretcutter.

The appearance of polished or varnished wood is different to some extent from what it is when the wood is in the natural or unpolished state. As a rule the depth and richness of the colour is increased. In the absence of a polished piece, the appearance can be judged very closely by wetting the surface of the wood with water. While the gloss caused by this remains it may be compared to polish.

All kinds change in appearance with time, most of them getting darker “as the years roll on.” A few of the more brightly coloured ones, such as tulip wood, fade.

In addition to those woods which have been named as generally used in the form of thin veneers, there are many others which are used principally in this state, and a brief enumeration of some of the principal will be useful. As veneers they cannot be used except for inlays or overlays, as they are not thick enough to form anything of by themselves. Both these forms of fretcutting will be treated of in due course, but it may occasionally happen that the cutter wants to do something in a choicer wood than he can obtain in the solid. In this case, the only way is to mount the veneer beforehand on a solid piece of the necessary thickness, and then proceed to cut it as though it were an unveneered piece of board. If the board is veneered on both sides it will be almost impossible, except by the closest examination, to see that it is not cut out of a solid piece. By this means a considerable saving in the cost of material may often be effected, and, as already suggested, it is the only way in which some veneers can be used for plain cut through frets. In order that the edges may not betray the fact of a board having been veneered, it is necessary that the foundation and the veneers should be of the same kind of wood. Thus, if a choice Spanish veneer is being used, let it be mounted on a piece of cheap plain Honduras. The endeavour must be to have the foundation of the same colour as the veneers. If this cannot be managed, the edges must be afterwards stained. As the process of laying veneers is a difficult one without a

good deal of experience, the best way for the amateur to do in such cases is to enlist the services of a cabinet-maker who is conversant with the work.

The following veneers are among those which are mostly used :—

Amboyna.—Very full of figure, something like burr walnut, only of a rich golden-brown in colour.

Box.—This is a yellow wood without much figure. Very useful for inlaying purposes.

Purple Wood.—The character of this is sufficiently indicated by its name. It has very little figure.

Thuja.—Similar to Amboyna, but darker and more coarsely marked.

Tulip Wood.—This is in rows or stripes of colour in various shades of red and yellow.

In addition to woods which are used only as veneers, the choicer kinds of almost all varieties are to be had in this form.

There are also a large number of whitewood veneers dyed throughout their thickness in almost all colours, and these are much used by marquetry-cutters. They show little or no grain.

Among the miscellaneous things which are used in plain fretcutting, the following are the principal :—

Ivory.—This is seldom used, except in the choicest specimens of work. It is hard, and should not be attempted till a considerable degree of certainty in the use of the saw has been acquired. An excellent substitute will be found named later on.

Mother-of-pearl is another material which is much used in small pieces in marquetry work. Judiciously introduced it has a most pleasing effect, but it is a most unpleasant material to saw. There is no good imitation made.

Tortoise-shell.—This is a most effective material, but also an expensive one, so that an imitation which is easily procured is generally used instead. The real is unpleasant to saw.

Metal.—This is used principally in the construction of small ornamental parts, such as hinge plates, keyhole escutcheons, and

only as an in- or over-lay. Thin brass and zinc are those most commonly met with, either plain or nickel plated. If preferred, the metal pieces required for any piece of work may first be prepared in the ordinary metal and afterwards nickel plated. If brass is used, it may be polished and prevented from tarnishing by coating it with a lacquer.

Vulcanite.—This is a hard, tough preparation of indiarubber, and may sometimes be used in preference to black veneer. It may be dispensed with in favour of the next material, which is pleasanter to work with.

Xylonite.—This material is one which may fairly be considered as the most useful, after wood, which the fretcutter or marquetry-cutter can use. It is sometimes erroneously called celluloid. One great advantage which xylonite possesses is the fact that with it almost any material which can be manipulated by the fretsawyer can be imitated with the utmost fidelity. The only exceptions seem to be metals and mother-of-pearl. The imitation of ivory is simply perfect in its resemblance to nature. The same may be said about it as an imitation of tortoise shell, so that whenever it is desired to use either this or ivory, xylonite may be substituted. Among others may be mentioned various kinds of marbles, amber, coral, lapis lazuli, malachite, agate, onyx, etc. It is made in an almost endless variety of plain tints, both opaque and semi-transparent, so that the marquetry-cutter who is well provided with an assortment of xylonite in its various aspects is rendered almost independent of other materials. Not the least important advantage which it possesses for the amateur is the facility with which it can be cut by the saw, for it is absolutely without grain and soft. As it is also tough, the finest work can be done in it much more easily than with veneers, which are apt to split or break.

The ivory imitation is often retailed under the name of ivorine. The success with which marble and stones are imitated in xylonite renders it of peculiar advantage to those who wish to imitate Florentine mosaic inlaying, in which thin sheets of marble are almost entirely the sole materials, and are not very easily cut. It may be interesting to say here that much of the modern ivory (?) inlays that are seen owe their origin to this wonderful material, which apparently bids fair to oust the elephant from his position as sole purveyor of ivory.

Xylonite is manufactured in sheets of any thickness up to about 1 in., the variations being reckoned by hundredths of an inch. The gauge most suitable for marquetry work in connection with ordinary veneers is $\frac{4}{100}$, or $\frac{1}{25}$ of an inch. For plain fretcutting, on account of the expense and the fact that wood may be used for large work, only small articles will be made entirely of xylonite. For these it is well adapted, not only on account of the high degree of finish which may be given to them, but because, the material being tough, such articles are not liable to be broken. From some reason or other this material has been almost neglected by the fretcutter and inlayer, probably because he is not aware of its existence or the facility with which it may be obtained direct from the manufacturers. To the professional marquetry-cutter the ivorine form of xylonite is by no means unknown, but naturally he does not give undue publicity to his knowledge. Except in very thin sheets, so thin as to be almost useless, xylonite is not obtainable through the ordinary dealer, but the manufacturers, The British Xylonite Co., High Street, Homerton, E., will either supply it direct or give the name of the nearest local dealer on application. Although we have spoken thus highly of xylonite, it must be understood that we do not recommend it to the beginner.

In the course of future chapters the peculiar treatment of xylonite will be more fully explained in connection with its actual working.

CHAPTER VII.

EXERCISES IN SAWING WITH THE HAND-FRAME AND THE MACHINE.

THE learner may now begin to use his tools. He may at once try and make something, but any attempt of this kind will not result in anything satisfactory, and the wood may be considered wasted except for the valuable lessons which will have been learned. Perhaps the chief one will be that fretsawing is not so easy as it looks, and that the art must be learned by experience.

Instead of attempting to saw out a design at first, the novice will do well to practise a series of exercises in order to obtain command over his tools and to learn to saw with precision. This preliminary practice may not be interesting, but it will be useful, and is neither so tedious nor so prolonged as would be necessary in almost any other mechanical pursuit. Whether the beginner starts with a piece of real work or adopts the course recommended, there are certain matters upon which it will be necessary for him to be informed, and as far as can be we save him the trouble and waste of time which would be involved were he to experiment on his own account without a guide.

We will first of all suppose that the saw-frame is to be used, and not a machine, though many of the remarks are applicable to both. If the method of using it with facility has been acquired it will not be a difficult matter for the learner to use the machine.

The adjustment of the saw-blade to the frame is the first matter which requires attention; there are several details which must be understood if the work is to be done efficiently. On examining a saw-blade, its teeth, in common with those of other saws, will be found to be sharpened with the points in one direction.

The cutting of the saw is only effected when the saw is being drawn through the wood so that the sharp points act. Drawn

the other way its cutting powers are almost *nil*. Thus the direction in which the teeth point is a matter of considerable importance when fixing a blade. The cutting action should be during the downward thrust, therefore the teeth must point in that direction. In a machine consequently there can be no mistake, but with the hand-frame the beginner may ask whether the teeth must point in the direction of the handle or away from it. The answer will depend on whether the handle is to be above the work or below it, whether the sawing is to be done by pulling the blade down, or by pushing it from above. Both methods are practised, and as there are advantages belonging to both, the learner should practise them. In a short time he will probably find that one or other is more convenient for him, either from the position in which he usually works or from the nature of the work in which he is engaged. The pulling is perhaps the action more commonly adopted by amateurs, probably for the simple reason that most of the professed guides to fretcutting mention it only.

With the other more command is kept over the tool. In theory the line that is to be cut is worked to the saw, this being held in one position, as it is in the machine. In practice, however, this is not strictly adhered to, for it is a great convenience to be able to swing the saw frame about—there is greater freedom in working. When actual sawing is commenced the frame can be swung with much greater freedom when the handle is above the woodwork than when it is below. To fix the saw-blade, fasten one end in one of the cramps of the frame, then compress the two arms slightly towards each other and fasten in the other end of the blade. The previous compression of the arms will draw the saw-blade tight, but whether the tension is correct or not must be learned by experience. As the operation of fitting the blade may be an awkward one at first, the learner may be helped by pursuing the following course:—One end of the blade being fastened, place the end of the handle against the chest, and the opposite arm of the frame against the edge of the table or work-bench. The slight pressure requisite can now be easily given, leaving both hands free to fix, adjust, and screw up the other end of the saw, as in fig. 29. Generally it will be found easier to fasten the end of the saw nearest the handle first, but this small detail depends on circumstances, and the worker must just choose that which he thinks best.

The exact degree of tension for the blade is a difficult one to decide, or to convey an exact idea of to the learner. As it is a

matter of considerable importance, attention must be paid to it, and a little observation will enable the novice to determine it for himself. The blade should be so tight that it gives a clear ringing sound when sharply released after being fingered like a banjo or violin string. If it is too tight it is very likely to break, so that



FIG. 29. FITTING BLADE TO SAW-FRAME.

care must be exercised. If too loose it will be impossible to saw correctly with it. However unsatisfactory these somewhat vague directions on this detail may seem to be, unfortunately nothing more definite can be given. Naturally a fine thin blade will not stand so great a strain as a larger and coarser one, so that the learner should not attempt to use anything finer than the largest

of the sizes already recommended as suitable for this purpose. For preliminary practice they will saw with sufficient cleanliness and save much waste from breakages.

The saws and the way to fix them being understood, the learner will be able to use them in cutting wood. It will be useless to go to much expense with the material, as odd pieces will do very well.



FIG. 30. SAWING WITH HANDLE UP.

Old cigar boxes, baking-powder boxes, and such like, which are generally made of thin wood, can be got from a tobacconist or grocer for little or nothing, and will answer admirably. All that is necessary is that the wood should not be hard and not more than $\frac{1}{4}$ in. thick at the most. Even this thickness is not recommended at the commencement, and nothing can be better than part of an old cigar box.

Let us assume that the first lesson is to consist of merely cutting straight lines across. The lines should be drawn with a pencil, or marked distinctly by some other means. It may be thought a simple enough matter to saw across a piece of wood without these guides, but it is a job which an experienced worker would not attempt; and, moreover, as the art of fretcutting consists almost entirely in sawing accurately to given lines, it will be well to accustom one's self to do so from the outset. That the lines are all strictly parallel or even straight is of little importance. Let the lines be ruled across at distances of $\frac{1}{2}$ in. or so from each other, and with wood and saw prepared, the beginner is ready for work.

Lay the wood on the cutting-board so that the line near the centre of the piece is over the opening, the cutting-board being fastened to the table, then with the handle of the saw in the right hand, which it may be assumed is to be above the work, so that the sawing is done by a thrusting downwards, place the edge of the saw against the wood, the blade being as nearly perpendicular as possible. In order to steady the motion of the saw, the uppermost part of the frame should be against the worker's forearm and under it, as shown in fig. 30. The motion should be as much as possible from the shoulder, and not from the elbow. The first difficulty will probably be encountered at the first stroke of the saw, which, instead of entering the wood at the exact point where it is intended, will very likely make one or two false cuts, marking the edge of the wood. On this account be careful to make only light short strokes till the line is fairly entered on, when the pressure and length of stroke may be increased as much as is convenient. For obvious reasons, however, the pressure of the blade against the wood can never be great, and very little force should be needed to saw such thin wood as is recommended. The endeavour should be to saw with a regular even stroke at only a slow rate of speed and not with short jerky strokes quickly given. Just as much work will be got through, if not more, and with ease and comfort to the worker, than by proceeding at a quick rate. The saw of course will not cut closely to the line at first, and it may not be out of place here to say that a perfectly straight line is difficult to cut accurately. It may on that account be wondered why it has been named for the first lesson, but it must be remembered that it is not so much for the purpose of cutting straight as to enable the learner to gain acquaintance with and obtain some command over the saw that it is suggested. To expect the beginner to saw to a straight line at first would be unreasonable

but if he attempts to do so he will not at any rate be perplexed by having to turn the wood constantly in order to saw to the line, as would be the case if curved outlines were given. When sawing, the blade will give to a small extent either sideways or backwards without breaking. The bending backwards from the pressure of the edge against the wood is almost unavoidable and in moderation



FIG. 31. SAWING WITH HANDLE DOWN.

cannot be objected to. The bending of the saw sideways shows that it is being improperly used, and though the fault may not be carried on to such an extent as to break the blade, it is to be objected to. The friction on the blade is increased to an unnecessary extent. Let it be remembered that it is only the front or toothed edge of the saw that cuts, and the less the sides rub against the

wood the better. Side pressure indicated by the bending of the blade means just so much lost energy. The saw-blade should be perpendicular, but to keep it so while sawing will not at first be an easy matter any more than the other requirements which have been mentioned. The cut will be made on the bevel, or on a variety of bevels within a very short space. However useful it may be to saw on the bevel or at a slope with the surface of the wood, it must be done with certainty and not at hap-hazard. In a succeeding exercise it will be found that the objections arising from the cuts being on the bevel will be more easily seen than in the present one. Nothing more need therefore be said at present about the necessity of keeping the saw-blade perpendicular. When the learner has managed to saw a little in the way indicated it will afford him useful experience to reverse the position of the blade and saw with the handle downwards. In a short time he will be able to decide which suits him best.



FIG. 32. CUTTING ANGLES.

The handle is grasped as before, but reversed in the right hand, with the frame resting on the forearm, as shown in fig. 31. The actual sawing and the precautions to be observed are as in the former instance. Probably the fretcutter will not be long before he discovers that the action is more constrained in this position than in the other. A good deal depends on the height of the table, on whether the sawyer is sitting or standing to his work, the relative heights of seat and table, and so on, as he will soon discover for himself. If he is standing to the work, the best way is for him to have the handle upwards. If he is sitting he may possibly find the other the most convenient. It may be observed that it will be better to stand than sit, as there is more freedom in working the saw, but those who take to fretwork as a recreation after they are tired with the day's labour may not be inclined to stand, and it should also be added stoop, more than they can help, and would not be able to indulge in fretsawing if they could not sit down to it.

Enough has been said on this point, and it amounts to little more than that it is a trifle more troublesome to saw sitting down

than when standing, but that equally good and accurate work can be done in either position. Experience will be the best guide.

The use of the treadle machine by the novice will be found later on; as the exercises here recommended will be as good for it as for the frame. When the plain straight lines named can be cut with comparative ease without the saw sticking or breaking, *i.e.*, when it can be got through the wood nicely, the learner may as well try something else, and it will not be long before he can do so.

The next lesson is straight lines also, but involves cutting angles in which the saw-blade is turned at the end of each straight cut. A similar piece of wood to that already used will do as well as anything and should be marked out with zig-zag lines. At first these should have obtuse angles, as **A** in the diagram, fig. 32, and gradually become more acute till they resemble **B**. The length of line from point to point is of little consequence. Whatever the length the angles remain. Whether the lines be drawn across the grain of the wood, or with it, does not much matter, in fact, if impatience does not prevent the learner from proceeding slowly, it will be well to practise in both directions. He will not be long before he discovers that there are trifling differences which are more easily felt than described.

The straight cut from the edge of the wood to the angle will be easy enough, but when turning the saw, or rather the wood, to work into the other line, a difficulty will be experienced. If an attempt is made to turn all at once, or by jerking, the chances are greatly in favour of the saw being broken. Instead of doing so, as soon as the angle is reached continue to work the saw up and down without, however, allowing it to cut further forward. Indeed, if anything it should be drawn back a trifle, just enough to ease it off from cutting. While continuing the sawing motion, turn the wood gradually and gently with the blade as a centre pivot, so as to bring the front edge of the saw on to the new line, when the cutting is proceeded with. The action of the saw wears a hole in which it can turn without breaking, and it is desirable this hole should be as small as possible. It is true that in ordinary fretwork the saw can sometimes be turned in the waste wood, so that it does not matter what size the hole is, but it will be better for the learner not to rely on being able to do so, as there are instances where it is not desirable, even if practicable. The wood is turned when cutting an angle, but as a matter of fact the saw-frame is generally moved or swung slightly also to meet the wood. When turning the novice must be careful not to bend the

saw sideways. The saw or the angle is to be the centre of a circle, and the wood turns on it. At first it will not be easy to avoid bending the saw and very likely breaking. After the turning at the angle can be managed, the next difficulty will be to get the saw to strike the line exactly so that the cut can be a perfectly straight one from corner to corner. Practice only will give the power to do this.

Curves may next be cut, and probably no better beginning in this direction can be made than by marking out semicircles or

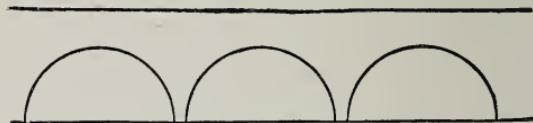


FIG. 33. CUTTING SEMICIRCLES.

segments of circles at the edges of the wood, as suggested in fig. 33. As a start the circles should not be of less diameter than that of a penny. As skill is acquired the size of the circles may be diminished and be varied by curves of different formation. The sawing is exactly as described for straight lines. The wood should be fed regularly to the blade, which may also be turned as far as convenient. When cutting a circle, on no account must the cut ever be straight toward. What is wanted is an evenly curved line. This is not so easy a matter as it may seem, and

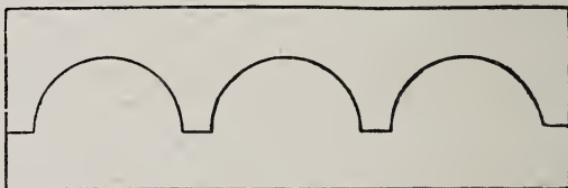


FIG. 34. CUTTING LINES AND SEMICIRCLES.

circle sawing is valuable practice, as little irregularities are so easily discernible, far more so than on flowing scrolls or curves.

It will be a good exercise to cut a series of semicircles, as suggested in the diagram, fig. 34, where there are not only the curves, but the turns from one semicircle to the other. These are

managed exactly as in the case of straight lines, but more skill will be required. The lines may be varied by others in which the angles differ, and in which the change from straight lines to curves of different degrees will afford excellent practice.

By the time the various lines indicated have been cut, the learner ought to have acquired a considerable amount of skill in manipulating the saw, and should find no difficulty in cutting any simple piece of fretwork. At this stage the conformation of the lines is of no importance, as the object is gained if the sawing be done to them. In working out designs all sorts of curves and angles are met with, and till the worker can follow any of them with great accuracy he cannot consider himself a proficient.

Simply cutting the wood without lines to saw to does not afford the practice which is desirable.

CHAPTER VIII.

ADVANCED EXERCISES FOR SAWING AND MACHINE WORK.

IN the preliminary exercises the saw approached the lines from an outside edge of the wood, but in an ordinary fretwork design most of the lines must be got at from the inside, *i.e.*, there are pieces to be cut out.

As a very simple example, let us suppose that a square, as illustrated in fig. 35, or some similar figure, has to be cut out. The

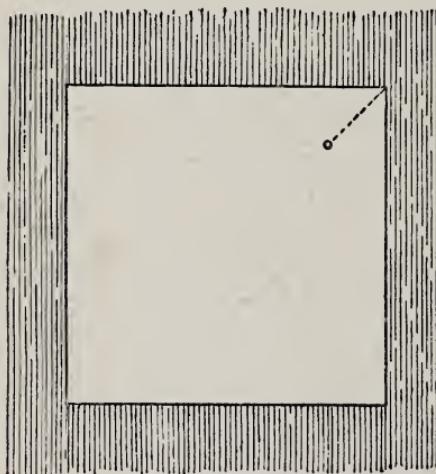


FIG. 35. CUTTING OUT A SQUARE.

hole for the saw must be bored within the four lines. In a small square it does not much matter where the hole is, but in a large one it may as well be near the place at which it is intended the sawing on the line will begin, the saw will have to be worked through the wood from the hole to the line of the design, and this cut it is desirable to have short. It would be creating an unnecessary amount of labour to make the hole near the centre of the square, and this remark applies to all pieces, whatever their shape may be.

The question is, at which part of the design or line will it be best to commence sawing? Practically the choice lies between doing so on a straight line or in an angle, and though it can hardly

be said that there is any definite rule, it will be better for the beginner at any rate to start at one of the corners.

It may be supposed that the hole is drilled somewhere near A in the diagram, and the first thing to be done after drilling it will be to thread the saw through it. Fasten one end of it, as before, in the frame, pass the saw through the hole, and clamp up the other end. In doing so be careful to support the wood so that it does not rest on the blade, which if only thin and fine is apt to be broken otherwise. This precaution is always necessary with a heavy piece of wood, and even with light pieces is advisable. The wood is then placed on the cutting-board as before, and sawn through in the direction of the dotted line till the corner is reached, when the line of the design is to be followed.

As the saw might either be turned in the outer piece of wood or in the piece to be cut away, it may be necessary to say that it should be done in the latter, in order to get a perfectly sharp-cornered square opening.

The only other inside piece of wood which it may be necessary to cut in order to illustrate methods is one in which there is no corner for the saw to start its course on the design. It is well to practise cutting a round or oval piece of wood out. As a matter of fact, it is seldom necessary to cut a round hole with the saw, for it is simpler to do so with a bit of suitable size. It is, however, not everyone who has a joiner's brace and assortment of bits, and it is desirable that the fretworker should be able to saw a circle which is sufficiently accurate.

In this instance, as in the former one, the hole, or, as it is sometimes called, the saw gate, must be made with the drill in the waste piece near the line, but not on it. There is, however, no corner or point to start from, so that the saw must meet the line at a place where the slightest defect in cutting beyond it would be detected. Care, therefore, is very necessary. As it is a very difficult matter to turn the saw just when it meets the line, the best way is to turn it a little before and work gradually on to the line, as suggested in fig. 36, where the direction of the saw from the hole is indicated by the dotted line. As the saw on the completion of the circle will probably break through the thin wood, the opening will not be perfectly regular on account of the small portion projecting; this can easily be filed away. It will be noted that the saw approaches the line very gradually.

Either a square or a round piece should fit in, not only in the same position as it occupied in the wood originally, but in any

other, and the learner may think that unless he can do this there is something defective with his work. Strictly speaking, there is, but he should not be discouraged on this account, as it is by no means easy to cut, say, a circular piece so accurately that it may be turned round easily in the opening from which it is taken.

In connection with these pieces, there is one very important matter which should not be overlooked. The necessity of a vertical cut will be acknowledged if any

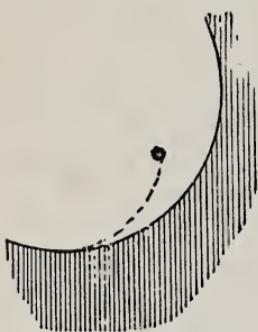


FIG. 36. CUTTING OUT
CIRCLE.

piece of fretwork is to look clean and sharp, and the learner may easily test the accuracy of his work in this respect. If the saw-blade is held so that it cuts on a sideways slant through the wood, the waste piece is larger on one side than the other, and the hole from which it is removed is correspondingly defective. Whether it is so or not can easily be determined by seeing whether the piece will go through easily either upwards or downwards. Let us suppose that the saw slants so that the waste is smaller on the lower side than on the top. It will then

be possible to remove the waste by pushing it from below, but if pushed downwards it would not pass through. This slant or cut on the bevel is taken advantage of for simple inlaying, but in plain open fretwork it can in the majority of cases only be regarded as a fault. As absolute precision is not easy of attainment, it may be well to note that any divergence from the strictly perpendicular may generally be in the direction of undercutting without disadvantage. In many instances a slight undercutting in this manner may even be of benefit to the appearance of the fret, though the effort should decidedly be to get the edges perfectly perpendicular to the surfaces. Slight defects are not so observable in thin wood as in thick.

So far only simple exercises have been described, and in connection with the hand-frame, but there are many typical examples of outlines and corners which will be constantly occurring in practice, and a few suggestions as to the best way of cutting them will be of advantage to the learner. Before proceeding to discuss these, a few remarks on cutting with the machine may be given, the exercises in connection with it being the same as those recommended already for the hand-frame. It must be understood that the

action is precisely the same, and the only points of variation are in the peculiar difficulties incidental to each mode of working the blade.

As each machine has special features, the following remarks can only be taken as of general application, but those who attend to them will have no difficulty in adapting them to whichever machine they may prefer.

We may begin with the point last referred to in connection with the hand-frame, viz., perpendicular cuts. Perhaps the best way to arrive at what is desired and give the learner a proper appreciation of the difference between cutting on the bevel and perpendicularly will be to cut first on the bevel in an exaggerated manner. This can easily be managed by fixing the tilting table at a considerable angle. The wood is then sawn from the edge. A cut having been made, the wood is to be turned over and another cut made near the former one. The two cuts instead of being parallel will diverge from an imaginary centre line to the same extent, as shown in fig. 37, which shows the edge of a piece of wood so treated. Having seen the effects of a cut on the bevel, try and adjust the table for a perfectly true straight cut.

If the table is true, the cuts will be perfectly parallel, or what is the same thing the saw will enter one when the wood is turned upside down.

When putting a blade in the machine, it is generally better to fix the lower end first, as the upper end can be now readily fastened after it has been passed through the hole in the wood. The hole should be as large as it conveniently can be. The smaller the hole the greater the difficulty in putting the blade through.

When sawing, keep the wood with just sufficient pressure against the edge of the blade to allow of proper sawing. If the pressure is too great the saw will very soon be broken. With the idea of preventing excessive pressure, or reducing the risk of the saw being broken, some machines have a small roller for the back of the saw to work against, while others have a piece of metal with an angle to act as a guide. The effect is to increase the friction on the saw, and except in theory we cannot admit that they prevent breakage or are of any benefit.

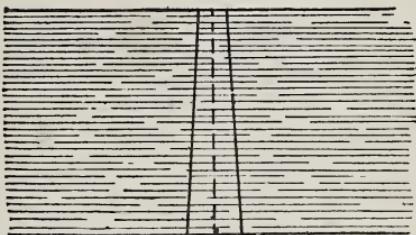


FIG. 37. TEST FOR VERTICALITY OF BLADE.

In machines with movable arms the side play caused by these working too easily on their pivots is apt to cause irregularity in the sawing. This therefore should be looked to, but if they are fixed too tightly the labour of sawing will be unnecessarily increased. Another important matter is to see that the saw-clamps are on the same straight line. If one is fastened so that the saw has its teeth straight to the front while the other one twists the saw to the left or right, the work can hardly be accurate and neat. As the clamps on all machines can be adjusted, care should be taken to make them right if they are not so. If both clamps are fixed so that the saw cuts a little to one side, that is, if instead of the wood being fed directly towards the back of the machine it must be fed slightly to the right or left, as the case may be, no great harm will result, for all the sawyer has to remember is the direction and extent of the "bias." Speaking generally, the more accurately the clamps are adjusted the better will be the quality of the work which it is possible to do on any machine. These may seem very trivial points to call attention to, and at first the novice may not appreciate the advantages of accuracy. As his skill increases he might wonder how it is that sometimes true sawing cannot be done, and be inclined to blame the machine instead of simply its adjustment. As a rule machines are sent out fairly adjusted, and it may happen that there is no need for any alteration. On the other hand they are not always so accurately fitted as might be, and the purchaser of one will labour under no disadvantage by knowing what to do in case of need. A good way to test the accuracy of the saw stroke is to bore a hole, through which the saw will pass easily, in a piece of wood and work the machine slowly and without cutting the wood. The relative positions of the blade to the edges of the hole at different parts of the stroke can easily be noted and corrected.

Another point to be noticed is whether the blade, looked at sideways, is perpendicular. This depends on the clamping up each time rather than on the adjustment of the machine, and for most work is not a matter of much consequence; for fine accurate sawing, however, the saw should be fixed as nearly perpendicular as possible. In case our meaning is not clear, let it be supposed that the lower end of the blade is fixed as near the front of the clamp as possible and the other close to the back of the top clamp. The lower part of the saw will press against the wood, but the pressure or cutting action will diminish as the saw is depressed, till by the time the end of the downward stroke is reached there is a space

between the teeth and the wood with which they should be in contact. In practice the contact of the wood against the teeth is more or less maintained by the worker, but the cutting cannot be so regular as it should be. Unless working very slowly, blades will be broken, and a very unpleasant jerking is experienced by the worker. In cutting corners or angles, any irregularity such as that mentioned will be more distinctly detrimental than with straight lines or curves, and, principally in machines which have movable arms, or when working without the presser foot, do not use this to *press* the wood down to the table. It should allow the wood to pass freely and easily under it, while preventing the wood from being jerked upwards. In its absence the fingers must be used for the same purpose, and if the saw has been properly adjusted and fastened they will have very little to do in this respect.

This bending of the saw sideways is a mistake which the beginner is very apt to make, especially when cutting corners.

When working a machine it is better not to run it at a great rate of speed, in fact it should be worked slowly till considerable skill has been acquired. When corners are being cut it is better to reduce the speed considerably and to "ease off" generally with little or no pressure of the wood against the blade till the wood has been turned.

The position of the operator in regard to the machine and the work is not unimportant. A chair of the ordinary height is rather too low a seat for the sawyer to work without unnecessary fatigue, greater ease is gained by having a higher seat. As a high seat conduces to the comfort of the fretsawyer, so does sitting squarely in front of the blade conduce to accurate cutting. If he sits with his head to one side of the saw the difficulty of closely cutting to a line is increased.

The treadling may be a slight difficulty at first, but it is soon overcome, and nothing much can be done till the action is almost unconscious on the part of the worker. It will be found convenient to have one foot in advance of the other instead of both side by side with the instep over the axle. The former is the natural and common-sense way, but some sawyers adopt the latter and complain of its inconvenience.

CHAPTER IX.

CUTTING ANGLES AND VARIOUS OUTLINES.

ELTHOUGH various kinds of lines have been described for initiatory practice, there are many hints or wrinkles in connection with actually working to a design which are useful.

On looking at any ordinary fretwork pattern certain forms of constant recurrence will be noted. More or less modified, we find them in all designs. Thus we have sharp acute points, both on the waste and on the part forming the pattern. The former may be called angles, and the latter points, for purposes of explanation. As an example, fig. 38 with three angles and one simple point may be taken. This and others merely show the outline of the waste to be cut away, or the outline of one part of the pattern, as the intention is not so much to give a design for fretworking as to give typical examples which will assist in cutting any pattern. Taking the figure as it stands, bore the hole as indicated by the dot near the point, in order that the saw shall commence on the line at this. Sawing would then be continued till a corner is reached. The cutting action of the saw must be arrested and the wood turned round on it till the new direction of the line is reached, when the cutting can be resumed. The next corner is much sharper

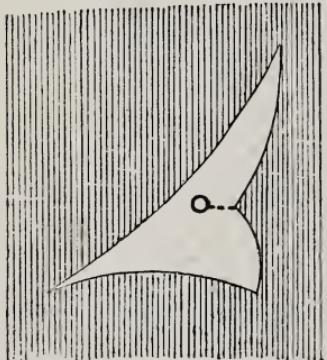


FIG. 38. CUTTING ACUTE POINTS.

and presents more difficulty, but it is to be managed in the same way, the only difference being that the saw may be drawn back a trifle more than before, so that the waste wood only is cut into. Were the saw to be turned right in the corner, instead of getting this nice and sharp, the blade will probably cut into the wood of the design and form a small round curve instead.

Proceeding to the next alteration in the direction of the line, viz., the corner at top of the illustration, the angle is very much more acute, the waste wood going off into a thin feather edge. To manage this neatly and cleanly so that the sweep of the line next to be cut on may be preserved will tax the skill of the fret-cutter, as it is by no means easy of accomplishment unless he just makes a bold dash at it by widening the point. This might be done without any serious disfigurement, but it would only be evading a difficulty. To cut such a corner, instead of turning the saw in it directly, work back, that is, let the saw come back a little in the kerf just cut, then turn in the waste wood and bring the back of the saw into the angle. Its teeth are now in the direction to be cut, and it is only necessary to saw on to the point at which the start was made. The saw should be worked slowly, and if properly done the angle will be no wider than the thickness of the saw-blade. Another way in which a sharp angle like this can be cut: After having sawn up to it, bring the blade back through the kerf till it is at a convenient part to turn and saw across to the point. From this make a fresh start and saw to the corner which has still to be completed. Very gentle action will be necessary as the blade approaches the corner of the waste wood, for the point of the waste wood being very thin is almost sure to break away and cause a difficulty in making the corner sharp. In this case the waste wood is cut into two portions, and it will be better to remove the first of them as soon as practicable instead of waiting till both are cut. The saw might have been brought on to the line of the design at the corner first referred to instead of at the point, but neither of the other two corners, from their acuteness, would have been so suitable.

Although we have explained how a very sharp corner may be cut, unless extreme accuracy is wanted such care need not be taken in ordinary articles of fretwork.

Taking points next, the ways in which they may be cut have now to be described. They are the opposites of the corners, so that what are the corresponding parts in the waste wood are reversed. With corners the preservation of the points in the

waste was of no consequence, with points as part of the design the preservation of the corners of the waste is unnecessary. On the whole, points are more easily cut than corners, the chief

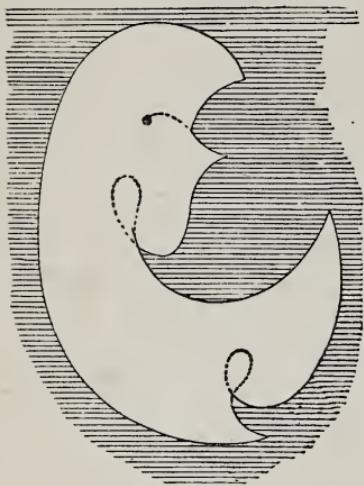


FIG. 39. CUTTING OUT POINTS.

distance, say the width of the saw, is cut beyond it. It may be easier, and in many instances advisable, instead of turning directly, to continue sawing in the waste, turning the wood, so that the saw never really turns but cuts its way again to the point where it continues on the line of the design. The dotted lines show the course of the saw at the point clearly. The next point, introduced specially for a reason shortly to be explained, is turned in the same way, and the cutting continued till the waste piece is dissevered. It may be wondered why the blunt point is selected as the one from which the start should be made. The start might have been made from any of the others ; but suppose we had done so at the thin sharp one, and sawn first along its upper or rounded outline. All would very likely have gone on smoothly enough till sawing round to its point again. From its shape it is very fragile, and having been severed from the wood on its upper side there is nothing to support it there. Assuming that the grain of the wood is across this point or tongue, the chances are that the least roughness, or any but the most tender sawing, would cause it to snap off before the point is reached.

difficulty in connection with them being to keep them unbroken when they are long and thin. To serve as an illustration fig. 39 is given. In it are two fairly sharp points, and one more obtuse. This latter, of course, presents no difficulty, but the others require some nicety in manipulation. As before, the hole may be drilled in any part of the waste, and we will assume a start is to be made at the blunt point. The saw meets the design at it, and follows the line to the large sharp one. The saw may be simply turned in the waste wood on reaching it, and it is by no means impossible, or even difficult, to do so if a short dis-

If from any reason, such as might arise from any contiguous parts of the design, rendering it advisable to start from this particular sharp point, the best way would be to saw along its upper side to the corner, draw back the saw, and start afresh from the

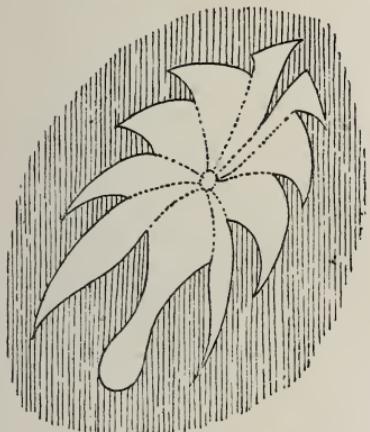


FIG. 40. CUTTING OUT POINTS FROM CENTRE.

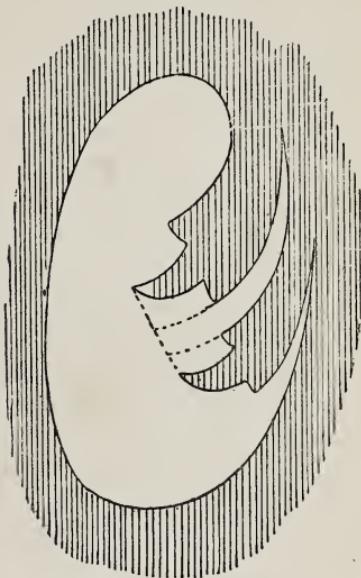


FIG. 41. CUTTING OUT LONG POINTS.

point, but this time in the opposite direction, so that the waste piece would be cut out by the time the saw had got round to the corner alluded to. In some cases it may be advisable to start each cut from the centre, so as to avoid any turning of the saw. As in a piece like fig. 40, it would be preferable to do so. In this instance the waste will come away in several pieces.

As a variety from this latter method of cutting a figure, which, for purposes of explanation, is intentionally an exaggerated form, one much more likely to happen is shown in fig. 41. In this instance it might be desirable, and in the majority of cases the easiest method would be, to saw round the main curve of the outline and then from point to point, as indicated by the dotted line, the piece of waste between the points being removed by separate saw cuts in the direction of the corner from the

points themselves. By this means the points are cut sharply without much risk of injuring them, and the corner is equally sharp and clean.

Patterns containing curves, as that in fig. 42, are by no means uncommon, and it is better to cut out the round piece in the upper portion of the waste by boring it instead of cutting it away with the saw. The drill, or whatever is used to make the hole with, must be of suitable size, and if so the curve will be more

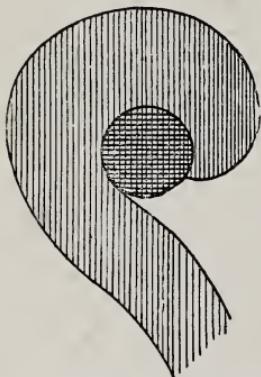


FIG. 42. CUTTING OUT CURVES.

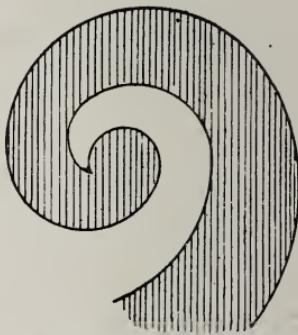


FIG. 43. CUT OUT CURVES.

regular than if sawn. The part to be bored out is shown black in the illustration. The drill, or suitably-sized boring tools, can often be used with advantage in similar situations.

Scrolls such as that shown in fig. 43 are often met with, and perhaps they are the most troublesome of all to cut successfully, not so much because of any difficulty in sawing the outline as in the liability of breakage from the grain of the wood being across it at some portion or other. Along one edge may be sawn without risk, but when the other is being cut great care is necessary.

In addition to these special examples, and in order that the suggestions offered may be taken full advantage of, it is necessary often that the design should be carefully studied to note what method of cutting would be the best not only for ease but to avoid, as much as possible, risk of breakage and injury. Thus it sometimes happens that there is a long thin piece with waste to be removed from each side of it. With thick strong wood there is not much danger, but with fragile stuff and a comparatively coarse saw

discretion may often prevent disaster. As a rule, it is always advisable to support weak parts of the design, and to cut them while some of the waste strengthens them. Thus in fig. 44 we

have a weak stem. Were the square or straight lines to be cut first, when cutting the second outline of the stem there would be little support to it. The best way — after one of the waste pieces has been cut out—is undoubtedly to saw down the remaining outline of the stem, and then proceed to the straight cuts.

It may be asked whether such examples as those given are met with in every fretwork design, or if every one of these is made up entirely of such or similar points, corners, etc. The answer must be in the negative. The illustrations given are merely specimens of what is likely to be met with, and the hints are for the purpose of enabling the

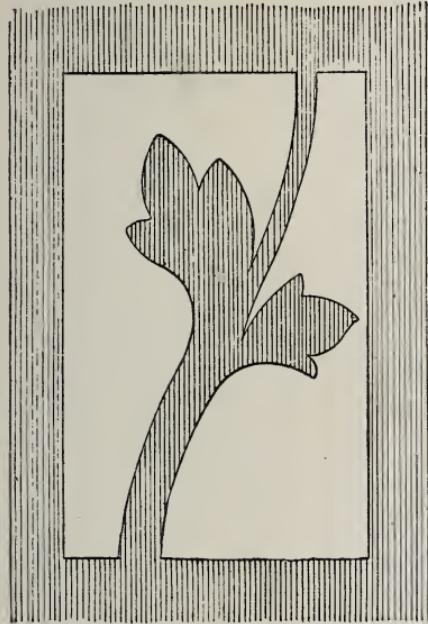


FIG. 44. CUTTING WEAK STEM.

sawyer while he is new at the work to avoid mishap. When he has made some progress he will be able to discern ways and methods most appropriate for the design he is working on. Each one requires different treatment, and probably among experts no two would be found to proceed exactly in the same manner. Some might want to turn out the work in the shortest time regardless of its finish, while others might prefer to spend more time in order to have the cutting as nearly perfect as possible, and not merely good enough to pass muster. The amateur who is not working for purposes of sale should aim at perfection in his work, and not grudge care nor time.

CHAPTER X.

DESIGNS FOR FRETTWORK, AND HOW TO USE THEM.

HERE designs not available for the fretcutter, all that has gone before would not be of much use to help him forward in the art, for it is by no means likely that many could or would be at the trouble of making their own drawings. Fortunately the modern fretcutter is largely catered for and he can pick and choose from many thousands of designs. The fretsawyer of the present day has a distinct advantage over his predecessors, for it is not so very long ago that designs for fretcutting were almost entirely confined to small pieces for ornamenting articles of furniture. The extent to which the great English cabinet-maker of the last century, Chippendale, relied on fretwork for the decoration of his furniture is no doubt well known to most readers, and the hint that they may ornament furniture which would otherwise be plain easily and artistically by means of the fretsaw will probably be useful to many.

It is, however, not so much our object at present to show how articles of solid furniture may be decorated by means of fretwork, as to show how things may be made up entirely of fretsaw work, and it will be an advantage to know something about the designs obtainable.

The beginner should get catalogues of designs from the various publishers. From these he will obtain a far better idea of the number and variety of the articles which can be made up than by any other means. He will also find the catalogues of great use for reference and for the selection of patterns, as most of them contain miniature illustrations from which a very fair idea of the articles described may be gathered.

Among English publishers may be mentioned Harger Bros. and

Skinner and Co. H. Lilles and Co. have an important collection of German origin. Italian and Belgian designs are supplied in this country by Busschotts. American designs are obtainable from many dealers. There are also many continental publishers whose productions, however, are not easily obtainable in this country.

A glimpse at the chief characteristics of the different designs produced in the different countries, or the principal of them, may not be uninteresting and certainly will not be useless to the novice.

English designs, as a rule, do not appeal to our fancy so much as many others, but this is to some extent a matter of personal taste. Without saying that many of them are not excellent in conception, especially the later productions of the leading publishers, we cannot discern in the vast majority of them the same artistic merit as in the chief continental design. Comparatively few of them afford satisfaction to those who have made a study of design. The chief English designs are printed in solid colour, *i.e.*, the wood which will constitute the pattern when cut is represented by ink in the full width of the part and is not outlined, so that the saw must be guided along each edge of the print instead of cutting along a thin printed line. There is no objection to this, especially if the colour of the ink is not black, which is not so pleasant or easy to cut to as brown or some lighter colour. The colour is of small importance in a good light and if the work is only pursued for a short time, but other things being equal, we prefer a design in another colour, especially when working continuously. So far as the printing itself is concerned and general accuracy, the best English designs are unsurpassed, for every detail of the outline is given with the greatest clearness. American designs are very much on a par with the English, though not so well printed as a rule. There is a great want of delicate feeling noticeable in many of the larger designs, though some of them work out well. In size there is nothing to compare with some of the larger American designs, while the ingenuity with which really important looking pieces of furniture capable of being made by the fretcutter have been devised is remarkable. For the beginner, such things are out of the question. The prices of English and American designs vary in price according to size and other qualities, and are more costly than most others.

The German designs have earned a well-deserved reputation for

general excellence, and for artistic effect are far ahead of either English or American. They are printed in a pleasant tone of brown in outline, with the space filled in by lines more or less representing the grain of the wood, the waste to be cut out being left blank. In connection with the fact of these designs being drawn in outline, we may remark on a feature which if left unexplained might possibly cause the novice some little confusion and prevent his work being accurate. We allude to the outline not being of uniform thickness, for in order to give an indication of shadow the lines on the right-hand sides and bottom of the parts forming the design are printed more thickly than those opposite to them. This undoubtedly improves the pictorial effect of the designs, though at the expense of accuracy till the way of treating the thick lines is understood. When it is, no difficulty can arise, nor would possible defects from this cause be noticeable if the cutting otherwise were inaccurate. In cutting through the thin portions of the line no confusion as to what is intended can arise, but the other lines are occasionally so thick that a graceful curve may be marred unless attention is paid to the position of the saw with regard to the line. The line is considerably wider than the saw-kerf, so that the saw may be worked through the line without the fret being accurate. In large work the defect may not be discernible. The extra thickness of the line represents shadow, which does not require to be cut through. When sawing, it ought to be disregarded, and the saw should be guided by the inner edge.

The German designs are sold at a low price. One thing in connection with these is noteworthy, and that is the distinctness of the styles in which they are drawn. Few of the designs are for articles of large size, by which we mean important pieces of furniture, as the artists appear in most instances to have recognised that fretwork has its limits, and that everything cannot appropriately be formed with it. It must not be inferred that only trivial things can be made from these designs, for most of them are distinctly both useful and ornamental.

The Italian designs are not so well known as they deserve to be in this country. They are printed in solid blue colour on sheets of uniform size, and are sold at a cheaper rate than most of the English designs, though they are slightly higher in price than the German, to which reference has been made. The delicacy of treatment is very marked in nearly every design, and many of the finest cannot be adequately cut without considerable

skill. The prevailing style in which most of the designs are composed is that of the Italian renaissance—perhaps the most graceful of any for purely decorative purposes. Taken as a whole, the Italian series of which we are speaking is unsurpassed by any for inlaying either in two colours or for adaptation by the marquetry-cutter. From the small size of many of the articles they are also well adapted for working up in comparatively costly materials, and we know of none which so well repay for making them up in xylonite as inlays. Any amount of care may be bestowed on some of these designs in connection with this material without feeling that it is wasted, in fact it is a pity to cut some of them in any common wood. We may mention that we recently spent over a day and a half in making an inlaid panel measuring only 9in. by 2½in. As there are eight similar panels to form the completed article, our opinion on the value of some of the Italian designs will be understood without further comment. Many of the designs are comparatively simple, but even they will be more appreciated by those who have made some progress in fretcutting than by the tyro. It may be interesting to mention that the principal Italian design, and undoubtedly the finest and most important one which has been produced anywhere, is that for constructing a model of Milan Cathedral, one of the most beautiful buildings in existence. The magnitude of this piece of fretwork may be estimated when we say that it contains over 3,600 pieces, and that the completed model is 6ft. long, 3ft. wide, and 4ft. 6in. high. So far as we can ascertain it has not often been made. Needless to say that this piece of work is not suitable for a beginner.

Although there are many publishers in France and Belgium and elsewhere, their designs are not easily obtainable in this country, so that beyond calling attention to their existence no mention need be made of them.

We may now suppose that a design to be worked has been decided on and obtained as well as suitable wood, and that the manipulation of other necessary things in the way of tools is understood, so that the learner will be ready to accomplish his first piece of work. If he is wise he will not attempt anything complicated or difficult to make up, for the chances are he will fail with it, and a simple design well done is better than a more pretentious one faultily executed.

With regard to the wood, there should be some appropriateness between it and the character or style of the design, for though

this may be of comparative unimportance with small simple articles such as the beginner is recommended to confine himself to for a time—*i.e.*, it does not much matter what kind of wood they are made of—in more important articles a certain harmony between the wood and the design may greatly enhance the artistic value. No definite rule with regard to this can be laid down, but to illustrate our meaning we may take the model of the Milan Cathedral. Were this to be made of ebony, mahogany, walnut, or any brightly coloured or dark wood, anyone who knows that the original building is made of marble would at once experience a feeling that there is something discordant about the model. Clearly this would be better if made of some white wood, such as holly or ivory-grained xylonite; while no one with any sense of fitness would think of making up the model of an old “German House” in either of these, but would choose a dark wood, such as walnut, relieved perhaps here and there with lighter pieces. Again, what more appropriate for odds and ends in the Gothic or Elizabethan styles than oak, or in the Rococo (Chippendale) than mahogany.

Perhaps for a commencement nothing can be better than mahogany, walnut, or oak, and its thickness should be regulated by the design. On most of these the thickness is indicated, if not in words and figures, by sectional drawings. Possibly these may be across some part of the design, and unless explained might not be understood. A sectional drawing expressed in the plainest terms means merely that it represents a section or cutting across any portion of a piece of wood or a collection of pieces built up together. Thus a full-sized sectional drawing of a piece of wood 1ft. square and 1in. thick would measure 12in. long by 1in. wide, or, to take the more elaborate example named, if a box were represented in section we should have an exact representation of the thickness of the various parts with outline of mouldings, etc., as they would appear were the box to be cut through from top to bottom at the centre. In practice, sections, if they are shown in a drawing, are represented by a series of lines sloping parallel with each other. Contiguous pieces of wood are shown by the lines being sloped in a different direction, so that there is seldom any difficulty in distinguishing them. All the same, it is not always easy in any but the simplest forms of construction to understand at first sight the relationship of the various parts to each other. A sectional or working drawing, whether in full size or section, must be

studied before its meaning becomes quite clear. Some are naturally quicker than others in grasping this, and no doubt practice gives speed; just as in reading no one would expect to master the contents of a book by merely glancing through its pages, so with working drawings, they must be read and studied line by line till they are mastered, and to the novice they are written in an unknown language which he must learn. In the designs for fretworkers prepared for amateurs, his progress is considerably helped by the same parts in various positions, such as plans and sections, being lettered to correspond with each other. If these be read or gone over carefully there will seldom be any unconquerable difficulty in deciphering what at first seemed a meaningless conglomeration of lines. Even in this case, however, it is doubtful if what may be called a working drawing is not more or less unconsciously formed in the mind of the worker, or at any rate a plan of the construction elaborated. To do so is, however, to proceed by little more than guesswork, and is not to be depended on except in constructions of the very simplest kind, for loss of time and perhaps ultimate discomfiture is certain to be the result if anything elaborate be attempted without a working drawing. It may seem to be a waste to spend time over this, but in reality a saving is ultimately effected, not only in time but in material.

Where working drawings are not necessary, or where the necessary labour would be involved in making them explicit, a few explanatory words are generally given. In the Italian designs, working drawings proper are conspicuous by their almost entire absence, but the parts fitting together are so clearly and simply marked on the designs themselves that we cannot be sure that the plan adopted is not preferable for those who do not care to learn to understand the more complete and workman-like drawings.

The thickness being determined on, the next thing will be to get the design on the wood, and there are several methods by which this may be accomplished, each having advantages of its own.

The simplest is to stick the printed design itself on the wood and use it as a guide in cutting, but this is objected to by those who wish to keep the original design uninjured, as it is destroyed when fastened to the wood and cannot be used again. If it is desired that the original should be preserved, a copy of it must be taken in some way, either on paper to be stuck on the wood afterwards or on the wood direct. A brief description of the various ways by which this may be managed will be useful.

One of the most popular and useful methods is to trace the design on thin tracing paper. This paper is so thin and transparent that when laid over the original designs the lines are plainly seen through, and can be drawn on it either with pen or pencil. Either pen and ink or lead pencil may be used, but the former is to be preferred, as lines made by the latter are apt to become indistinct by being rubbed and handled while the wood is being sawn. In addition to ordinary tracing paper, any kind that is sufficiently transparent to allow of the lines being seen through it may be used, and we ourselves prefer the thin paper which is generally used for typewriter purposes. Whatever kind is used, it is stuck on the wood precisely in the same way as the original design would be.

Another popular method is to take copies by means of carbon or transfer paper used for manifold writing. On the table, drawing-board, or some smooth level surface, lay the sheet of paper on to which the design is to be transferred, above it lay a sheet of carbon paper, and on top the design. With a hard pencil, or better still a style like those used for manifold writing, go over the outlines of the design with a fair amount of pressure and they will be transferred to the bottom sheet. By placing transfer and carbon paper in alternate layers several copies of a design may be taken at once. The original will have black lines on the back of it if the ordinary transfer paper, blackened on both sides, is used, but those who wish to keep the originals clean may do so by using transfer paper which is only prepared on one side. Although theoretically the original is not injured by the adoption of this course, in practice it will be found that as it is the sharp point of the style cuts through or tears the paper, so that after a few copies have been made it becomes comparatively useless. If preferred the design may be traced direct on to the wood by means of transfer paper, and this plan will generally be found all that is necessary, as rubbings, explained later on, can be taken from the wood when it is fretted, and used as patterns if any duplicate frets are wanted. It is not practicable on very dark woods, such as rosewood or ebony, unless they are previously covered with light paper stuck on them. For light woods or even walnut there is no better plan than transferring direct to the wood. As the advantages of transferring direct may not be apparent to the novice, it may be well to point out to him that if paper is stuck on the wood it must be scraped or be removed by rubbing with glass-paper, and that to do this thoroughly is sometimes a tedious and always an uninteresting occupation.

With designs transferred direct this is avoided, as the wood only requires a slight "papering up" or rubbing with glass-paper in order to clean it. When tracing in any way, care should be taken to prevent the design shifting; were it to do so a faulty transfer would be the result. This may be easily managed by fastening down with drawing pins, or placing a weight of some kind on the paper. Straight lines should be ruled. It must not be expected that the transferred design will look so well as the original, but any trifling irregularity can be regulated when sawing, so that with reasonable care in making them the transferred lines will be sufficiently accurate for ordinary purposes.

We have stated that a design if stuck on the wood is destroyed in the cutting, and as there is a notion held by some amateurs that this latter need not be the case, a few words about this may not be amiss if only to warn novices against adopting a wrong course. Naturally when a sheet is stuck on the wood and fretted, only the waste is removed, so that to all intents and purposes the design remains intact. If, therefore, this paper be separated from the wood, as it undoubtedly may be, it can be stuck on a fresh piece and used again. So say these would-be wise ones who have advocated this economical plan. Now let us see how it works. To get the design, which is a replica in paper of the fret from the wood, it must be thoroughly wetted, and of course this cannot be done without wetting the wood. We have even seen it recommended that the wood should be soaked in water till the paper floats off. As the moisture is prejudicial to the wood in proportion to its extent, is it necessary to say anything more about this senseless method? The design may with care be got uninjured, but the fret itself will certainly be damaged to such an extent that considerable trouble will have to be taken to restore it thoroughly, even if this be possible.

A less objectionable plan—indeed, occasionally a desirable one, when the design is to be cut direct and to be preserved, minus the waste pieces of course—is to paste it on a piece of cardboard, or better still a piece of very thin soft pine which can be attached to the board to be fretted by means of fine wire nails driven through the margins and waste pieces, and clenched over so that they do not project from the wood, or by a little glue at the waste parts. Unless these or a sufficient number of them are large, there is a risk of glue getting in between parts of the design, in which case damage is likely to result either to the fret or to the pattern one. Another way of attaching two or more pieces to be sawn at

the same time is by means of a piece of paper glued between them. The pieces can then be separated more readily than if they were glued directly together, by inserting a thin knife blade between them—this tears the paper. When moderately thick wood is used this plan can be adopted with safety, but it is not suitable, though it is often recommended for veneers or for anything less than, say, $\frac{1}{8}$ in. thick. The exact thickness cannot be stated, for much depends on the fragility of the wood, fineness of the fret, and so on. The risk of any damage occurring may be diminished by using narrow strips of paper, preferably of a soft thick kind, placed at intervals instead of one piece the size of the wood, but wire nails are on the whole more convenient. Yet another plan by which what is virtually a replica of the original design, less the waste pieces, may be obtained even though the original itself be destroyed. As it is often requisite to have duplicate pieces of fret, and just as easy in many cases to cut two or more at the same time as it is to cut one, the original design may be stuck to the top piece of wood and a sheet of paper, not glued, inserted between all or any of the others, which will be fastened together with wire nails. The inserted sheets of paper are cut through by the saw along with the wood, and on separating them present exactly the same outline. When necessary, several sheets may be inserted between two pieces of wood, and any of them be afterwards used instead of the original pattern. One advantage, and often no small one, of putting paper between the pieces of wood, is that it may be used to lubricate the saw-blade. All that is necessary is to grease the paper beforehand. The best grease for the purpose is Russian tallow. The reason that tallow is to be preferred to some other kinds of grease is that it is sufficiently hard not to injure the wood by soaking into it as an oil might do.

When a large quantity of frets of the same pattern are required it is not unusual to substitute a piece of thin zinc for the paper between two of those first cut, and to use it for the purpose of reproducing the designs. The zinc fret is used as a stencil, so that the design on the wood appears in the natural colour of the wood, the waste being darkened according to the colour of the ink or paint used. Printed copies can easily be taken on paper from such thin metal frets by passing an ordinary inked printing roller over one side, which is then by pressure printed from. An almost unlimited number may be taken by this means, which it may be useful to be aware of. The wooden patterns above referred to may be used in a similar manner, but not so conveniently.

A simple and easy way by which to transfer designs direct to the wood is by using a copying ink pencil, either for the purpose of making a tracing on a separate piece of paper, or by going over the original design. The wood is to be moistened and the ink drawing pressed down it. Instead of water being used to moisten the surface of the wood, ordinary flour paste is to be preferred. The wood should be well smeared with this, and the paper then be pressed down, but instead of leaving it till it is stuck, remove it before the paste is dry. Occasionally several copies can be taken from the same drawing.

Designs may also be multiplied by means of any of the graph and other copying apparatus now so much used, but it is rarely that the amateur at any rate will have occasion to take many copies before cutting the frets, and he can then adopt simpler means.

Many other methods of getting the design on the wood have been and are practised and may occasionally be useful, though in the case of cheap designs it may be doubted whether the game is worth the candle in the majority of cases, and whether it is not better to use the original design to cut directly from. This, however, must be a matter for personal consideration. We think it is false economy to trace and transfer an elaborate design from one of the low-priced sheets. If the design is a costly one, or difficult to obtain, it is a different matter altogether. Among the methods to which reference may be made is that of sticking the original design on cardboard and then cutting away the waste with a penknife—making, in fact, a cardboard fret. From this rubbings may be taken as from a wooden fret. As these rubbings are so easily made the sawyer will not find it a troublesome matter to take them from all his work. All that is wanted besides the paper, of which almost any kind will do, is a piece of heel-ball, obtainable from a shoemaker. The paper is laid on the fret and simply rubbed with the heel-ball, which marks black on the pattern but leaves the waste untouched.

In addition to mechanical means of reproduction, of which those mentioned are the principal or usually adopted, the aid of photography may be enlisted. There are several photographic printing processes which are sufficiently cheap and easy to make them available by the fretcutter. That known familiarly as the "blue process" or Cyanotype is notably one of these. Almost any kind of paper may be used in it with sufficiently good results, only two cheap chemicals are required, toning is unnecessary, and

fixing can be done with water only. The paper may be bought ready sensitised, but we recommend the user to prepare his own, as the process is not difficult. The chemicals are ferri-cyanide of potassium (the *red* prussiate of potash) and ammonia-citrate of iron. An ounce of each will last for a long time. Dissolve each separately in about four times its bulk of water, and keep the solutions in separate bottles. The sensitising of the paper should be done in a dull light. It is not necessary that the same care should be used as with ordinary photographic plates, still the darker the room the less risk of the colour changing before it is wanted. Equal quantities of the two solutions must be mixed just before they are required for use, and then lightly sponged or brushed over the paper with a soft brush. A very little of the mixture goes a long way, and what is left over may as well be thrown away, as unless kept from light it will soon become worthless. Separately the two solutions keep well, especially in a dark place. After the paper has been sensitised it should be left to dry in the dark, after which it will be ready for use. As a printing frame of the usual kind of sufficient size to print many of the designs is rather an expensive affair and not likely to form part of the photographer's outfit, it will be very satisfactory to know that a printing frame of any kind may be dispensed with. A flat board of sufficient size to allow the design to be laid on it, a piece of felt, baize, or cloth, or even some sheets of paper to form a padding, and a sheet of glass are all that is necessary. If the glass is of the kind known as "plate," it will be better than the thinner varieties of sheet on account of its weight. To use this very simple substitute for a printing frame, lay the padding on the board, then the paper with its sensitive side uppermost. On this lay the design, and finally on top the plate of glass. Place in the light, with the sun shining on it, if possible, and leave till printed. The progress of the printing can be ascertained from time to time by sliding the glass a little on one side and turning up the portion of the design thus left free. As soon as the paper, except where the lines show, has turned a dark blue with a somewhat metallic lustre the printing is complete. When moving the glass before and after examining the print, be careful not to disturb the relative positions of the design and the printing paper. The print may be developed and fixed by soaking and washing it in several changes of water till there is no yellow visible. Where the water is "laid on" it will suffice to put the print on a board and let the water from the top flow over it. Hot water washes more quickly than

cold. As the unfixed chemicals are washed away the design will show out clearly in white on a dark fine blue ground. If the exposure has been misjudged, either by unduly shortening or prolonging it, no great harm will result. The print will not be technically perfect, but it will probably show all that is necessary with sufficient distinctness. This to some extent will also depend on the density and colour of the ink of the original design, which may be rendered less opaque by oiling it, so that the printing on the blue paper is more rapidly effected. One of the best oils to be used for the purpose of making the paper clearer is castor oil, as it is colourless and penetrative. Any excess should be wiped off before it is put in the "frame" in order that the blue print may not be greased.

An even simpler process than the one described is that in which bichromate of potash is the sensitising medium, but it is not so satisfactory, as the results are not so distinct. The colour of these prints is brownish with white lines, and with the exception of the chemicals used the process is exactly the same as the other.

If paper is to be stuck to the wood, either glue or paste may be used. For some reasons the latter is preferable, but it should be strong, so as to cause good adhesion all over, and free from lumps. It may easily be made by stirring flour into boiling water. If glue is used, it should be thin for this purpose. Strong dextrine is also good. Whatever is used, care should be taken not to wet the wood more than can be helped, and it would be better if the designs could be laid without any moisture. Of course this is impossible, and the only thing is to counteract bad effects as far as may be, for they cannot be avoided altogether. Thus, if the adhesive is put on the paper, this extends in size, and after being laid on the flat wood contracts as it dries and may cause the board to bend hollow.

If any tendency to twist is observable or is feared, the best way is to let the wood remain under a weight to keep it flat till dry, when the chances are it will remain so. With small narrow pieces such precautions will seldom be necessary, and they may be worked at almost directly if dried near a fire. To lay the various parts of a design as they appear on the sheet would of course entail a considerable amount of waste of wood, and this is not desirable. In order to avoid waste, care in the arrangement of the pieces may be advisable in order to make them fit as well as possible to each other. To do this, cut each portion of the design out with as little waste paper about it as convenient, then lay

them loosely on the wood till the arrangement seems satisfactory. Sometimes a good deal of saving may be effected by laying the designs, or rather portions, alternately on each side of the wood, which is the same in effect as if transparent and therefore reversible tracing paper were used. When laying the design or any portion of it, be careful to notice which way the grain of the wood runs, and place the design accordingly. As a rule it would be a fault to have the grain awthwart or diagonally across any portion of the design. Uniformity and fitness will best be conserved by seeing that the grain of the wood is in the direction of the greatest measurement. This system cannot, however, be invariably followed in fret-work articles, as may be gathered from the following instances. Let us first take a bracket composed of a back, a shelf, a support for this projecting from the back, *and* an ornamental piece of fret by way of backguard appearing above the shelf. As a matter of fact, in most designs this guard would be in one piece with the rest of the back, but there is no reason why it should not be cut separately. Now the grain in the part of the back below the shelf will naturally be perpendicular instead of across. Unless the continuation of the back is evidently to appear as an added piece, in which case the grain will run in accordance with the general rule stated from side to side of the shelf, it will follow the direction of the remainder of the back, in which case it might, without explanation, seem that the ordinary structural principles were neglected. It is, however, the exception which proves the rule, only the rule should not be slavishly adhered to when a departure from it may render the whole structure more harmonious in appearance.

When the design is on the wood, the next thing will be to cut it out, and here the real special work of the fretsawyer commences. Holes must be drilled in each waste piece, and these should all be made before any sawing is begun, as the risk of breaking is diminished. This is trifling if a drill is used. Of course the sawyer is in a hurry to cut the design out just to see how it looks. We know all about that, but we crave his patience just a little longer on what may at this stage seem an unimportant or trivial matter. Let him remember that each portion of the design is but a part of a whole. Is it only a box or a bracket or some equally simple thing, it must still be made up, unless the parts are to be nothing more than waste fret. Now, leaving the scrolls or fret lines, the borders or outside lines may look alright on paper, but if the wood is cut to them it will very likely require some modification before all the parts fit as accurately as they

ought to. It may be that only a shaving or two requires taking off, or a little easing here and there. Well let this be done before the fretting. But it may be said if the designs are accurate the parts must fit properly together, and we quite agree that they will *if* the designs are as stated. That they are not drawn so by the original draughtsman we cannot undertake to say, but what with the paper having been damped and consequently very likely been distorted to some extent and sundry other causes the designs are often a little "out" by the time the fretcutter starts to saw them. It can do no harm, at any rate, to test them by fitting them together, and it is better to do so before sawing and of course remedy any defects which may become apparent. The reason is that after the work has been fretted the liability to breakage will be greater than if the fitting is done while the wood is in the solid. Straight outside lines may as well be cut with an ordinary saw instead of the fretsaw, working slightly rather outside than inside the line. When necessary, corners should be tested with the square, as, for example, the back and top of the projecting piece of most brackets. If they do not form a right angle, of course the shelf which rests on the top will slope either to the back or front, and either would be objectionable. With the aid of the shooting-block the plane should be used to shoot the edges correctly. As more extended remarks will be found in a future chapter on fitting and making up articles of fretwork, nothing more need be said here on these points which we have merely hinted at.

Before actually beginning to saw, it will, especially if a machine with a presser foot is being used, be just as well to look at the under side of the wood and note if there is any burr or raised wood round the edges of the holes. If there is, let it be removed either by rubbing down with glass-paper or by cutting with a knife, chisel, or other sharp tool. If left, these rough or raised parts might cause the wood to become jammed between the table and the presser, and so interrupt the regular feed of the wood to the saw which is so essential to comfort and accuracy. The sawyer ought to be able to put in practice the principles explained in cutting, for the most complicated and elaborate design is nothing more than an arrangement of various curves and lines, each one of which must be cut separately. There is, therefore, no reason why anyone who can cut an easy-looking design—easy because it has only a few spaces or holes—accurately and well should not attempt a more elaborate piece of work. The chief

difference between the two is that this has more holes and will consequently require a longer time to execute.

With a few general hints on cutting, this chapter may be appropriately closed. The order in which the holes are cut is a matter of secondary importance, but weak members should have as much support as possible left till the bulk of the work has been prepared. Usually it is best to cut the insides or holes first, leaving the outlines till the last, but this plan is not always convenient. If the outline consists merely of a plain scroll, it does not matter when it is sawn ; but if there are points or weak projections from it, it is better to leave it till the last. As, in spite of all care, a piece will get broken off occasionally, it may be satisfactory to know that unless the broken part is lost it can generally be stuck on so neatly with glue that the fracture can hardly be detected. If the piece gets lost the best way to repair the damage is to cut the broken part of the fret through with the saw, so that it may have a clean edge, and if possible with the grain, which will seldom be difficult, as a fracture rarely occurs across it. Glue on a piece of wood of the same thickness as the remainder of the work and with grain matching as nearly as can be at the joint, of sufficient size to allow the missing member to be cut in it. When the glue has set and the joint is consequently firm, draw in the missing out-line and saw to it. If a member or portion of a design betrays any exceptional weakness, as it sometimes does, either from a local flaw in the wood or from other causes, the part may be strengthened by glueing a strip of calico on behind. This plan, of course, cannot be adopted when both sides of the fret are visible in the completed design when made up, but it may be sufficiently often to render its mention desirable.

CHAPTER XI.

MAKING UP FRETWORK ARTICLES.

FIN this chapter no pretence is made that directions are given for fitting together and making up all and sundry the articles which will come before the notice of the fretcutter. To do so would be impossible; there are, however, several leading principles and methods of manipulation which the cutter should make himself master of so that he may to a considerable extent be independent of the assistance of others. To be so thoroughly is almost out of the question, as it would then be necessary for him to be not only an expert fretsawyer but equally conversant with cabinet-making and French polishing besides.

Let us suppose that some wood has been got in a rough state. It requires smoothing. This will be done first by the jack-plane if the surface is very coarse, and finally with the smoothing plane, which should be set finely and have a sharp cutter so that only thin shavings are removed. In the event of a jack-plane not being handy to the worker, any carpenter can do what is required, or at a pinch the smoothing plane may be used alone. If necessary the scraper may be used after the plane, either before or after the wood has been fretted. The final cleaning and smoothing will be given by means of glass-paper. Coarse grades may be used to remove the paper of the design remaining on the wood and the finishing touches be given with the finer kinds. The finest papering up will not be given till the last thing, *i.e.*, after all the parts have been properly fitted together and are just ready for polishing, for most of the things should be polished in some way or other.

The edges of pieces of wood must be shot true and at the proper angles. If the straight edges are cut with the fretsaw they will be irregular; and the work will be more than if cut with an ordinary saw. This will leave the edges rough, and

unless used with considerable skill very likely a little out of the true. To regulate them, plant the wood firmly against the stop of the shooting-board, with the edge to be shot or planed slightly overhanging the edge of the board which guides the plane. This laid on its side in cutting must make the edges square if carefully applied. Mitres are trimmed in the same way by using the mitre block. To prevent confusion, it should be said that the mitred corners of boxes, tray, etc., cannot be cut in this manner, as the mitre block is only of use for frames, mouldings, and such like pieces. For boxes the mitre can be shot true by laying the pieces on the shooting-board, but instead of being flat let them be inclined at an angle in accordance with the number of sides of the box.

Those who do not possess a shooting-block with adjustable board may make use of the ordinary form by raising the wood to be shot to the proper degree by placing triangular blocks under it. Another method is by the use of the mitre bevel.

As some assistance towards accurate workmanship, those who have none of the aforementioned appliances may get blocks of wood cut at angles to correspond with those in the articles to be made up. These blocks—of which only one for each form will be required—can be prepared by any carpenter or cabinet-maker. They are to be used as guides. By planing the edges of the tray or whatever is being made as accurately as possible by eye, the fit can easily be tested by holding them together outside the prepared block, and planing, as may be necessary to ensure a correct and closely fitting joint. Those who are conversant with the use of the square will see that these blocks are designed to take the place of both it and the bevel. Probably one block each for octagonal, hexagonal, and square covers will be as many as the amateur will require.

Sides of boxes, etc., should be glued together, and the joint may be further strengthened by the use of nails or screws. The appearance of the heads of these is not desirable, especially in mitred corners, and they cannot always be used. Keying with thin pieces of wood or veneer may be adopted with advantage. This is managed by making a saw-cut in a slanting direction from the corner upwards and downwards, and then forcing in a thin bit of glued veneer to fill up the cut. When dry, the edges are smoothed off level, so that the joint is hardly discernible. This keying is frequently adopted in small fancy wooden boxes, so that if the construction is not understood the reader is advised to examine any small boxes (desks, work-boxes, etc.).

All glued joints should be kept close by pressure till the glue has set. The glue should be hot when applied, and as much as possible be squeezed out between the edges of the parts being joined. An excessive quantity of glue in a joint is a source of weakness, not of strength. Glue which exudes should be scraped away before it becomes hard. In order to keep glued pieces together tightly till the glue has set it will often require the exercise of some ingenuity.

Many corners or angle joints just glued without nails or keying may have additional strength given to them by glueing strips of canvas or calico along them. This plan can only be adopted inside constructions, or at the back where it will not be seen. In boxes, which are often lined inside, it may be easily managed. Fretwork articles are not intended to be handled roughly, so the joints which are used in ordinary joinery where strength is essential are not required. This enables the fretcutter to do what may be necessary with a very limited knowledge of joinery. Precision is more what is wanted than a close adherence to the ordinary rules of construction.

In addition to angle joints or corners there are other forms in which one piece is, as it were, stuck on to the face of another piece. A familiar instance of this is the projecting part of a bracket on which the shelf rests—except at the back. Such a piece may be glued and screwed, or nailed from behind, but occasionally the wood is too thin to allow of either screws or nails being used easily and safely. Glue alone might do, but it is better to leave a tenon or two projecting from the back edge of the projecting piece, as in fig. 45. These tenons will fit into mortises or holes cut for them in the back piece, and when glued up the parts will be firmly fixed.

Designs are often seen in which this construction is shown, but where it is not it may often be adopted with advantage. The mortise and tenon should fit each other accurately, and their position should be so arranged as not to interfere with the design. The length of the tenon should not be greater than the thickness of the wood in which the mortise

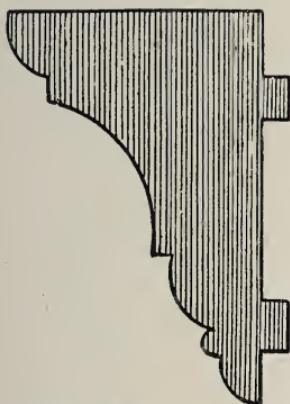


FIG. 45. TENONS TO BRACKET SUPPORT.

is. The mortise being straight may be cut with either the chisel or the fretsaw. If with the latter, let the hole be made rather small in the first place and enlarge it with the chisel till the tenon just fits in tightly. If made neatly and skilfully, the fact of a tenon joint being used should not be discernible except at the back.

Having a certain resemblance to the mortise and tenon joint is

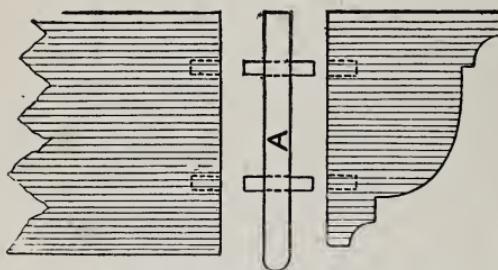


FIG. 46. DOWELS TO BRACKET SUPPORT.

that made with dowels or wooden pegs, which, though not a common one in fretwork, is yet occasionally more useful than any other. The dowel or peg may be compared to a nail, only instead of being inserted from the outside it is stuck into one piece of wood and the adjoining piece,

which has a hole to correspond, is forced down into it. It will be seen that a dowelled joint gives no indication of its character from the outside, and so far as appearance goes resembles a plain glued joint. Glue is used both on the dowels and on the parts of the wood which come in contact with each other. Fig. 46 illustrates an example where the dowel joint is useful. There are two sides, or portions of a side, with the shelf A intervening. The dowel pin is driven through this and into corresponding holes in the ends of the sides. The thickness of the dowel must depend on the thickness of the wood used. The pins should fit tightly into their holes, which should be quite filled without any empty space at the ends. This is especially necessary when the diameter of

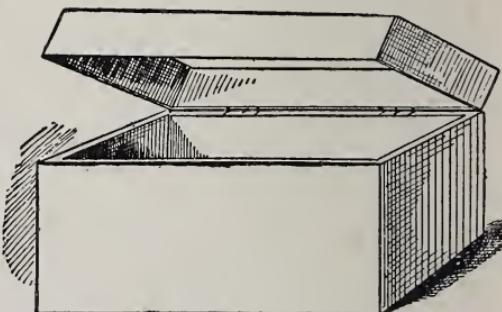


FIG. 47. BOX WITH FRAME TOP.

the pins is nearly as great as the thickness of the wood into which they are driven.

When making up boxes which have a lid fitted to a frame, that is, when a rim of wood is below the top in the same way that the ends, back, and front are above the bottom, as illustrated in fig. 47, it is not a bad plan to have both parts of the front, ends, and back fretted in one piece of wood, and separate them afterwards into the portions for the top and bottom. The lid portion can easily be cut off with an ordinary saw, and the edges smoothed down by planing or papering.

A fretwork box is to some extent a misnomer, for it would rarely be of any use if made up only of fretted wood, for the simple reason that if the holes were not covered in behind, the contents would not be secure from dust or from falling out. On this account, therefore, fretwork boxes are generally lined with some material, such as silk, velvet, cardboard, paper, or wood. In this latter case the lining may almost be regarded as the box on which the fretwork is laid as an outer covering. The fretwork may be made up as *the* box, and the lining of wood be glued to it inside. A better way is to make the lining into a box, and fasten the outer frets on afterward, fitting them accurately. The corners of the fret pieces should be mitred, and as the inner box will afford sufficient support they need be neither keyed nor nailed. They need not be thick, and good effects may be obtained by using only veneers. The frets are stuck on to the box with glue. If used in excess, so that it exudes from under the edges, there will be a difficulty or at least some tedious work will be required to clean it away. To ensure perfect contact between the fret and the box, small clamps, such as those mentioned in connection with the cutting-board, will be found useful, or the ordinary hand-screws of the cabinet-maker may be used. With these more pressure may be got. If there is a sufficient number, the frets may be laid at the same time, otherwise it will be better to do each one separately and wait till the adhesion is perfect before loosening the clamps. As the manipulation of all the parts is the same, whether done at intervals or in quick succession, so that all the parts are clamped at the same time, let us suppose the front of the box only is to have the front laid on. Proceed as follows:—Let a smooth piece of wood of any kind and thickness and not smaller than the front of the box be heated at the fire. It should be not merely warmed, but moderately hot. To explain what is wanted it may be said that the board or *caul* should be sufficiently hot to warm through

the fret and partially soften the glue, so that the contact between the two woods is perfect and the excess of glue is squeezed out. It may be just as well to warm the fret before rubbing the glue on, and the box too. If the fret is only small, the caul may be dispensed with, though it will be better to use it. The fret being glued, place it without loss of time on the box front in its proper position, for it must not be slipped about. Place the hot caul against it, and by means of one or two clamps bind firmly together. By keeping the handles of the clamp screws outside the box there will be no difficulty in fastening them up. To prevent the inside of the box being bruised by the ends of the clamps, a piece of waste wood may be put against the inside of the front. The same may be done on the outside, if it is deemed unnecessary to use a caul. The clamps should remain on till the glue has set.

Other articles of fretwork may be treated in a similar manner, and the manipulation will be the same.

The inner lining or box need not be of the same kind of wood as the outside fret, as a contrast is sometimes desirable. Pencil cedar makes a nice lining. Black generally forms a good background, though if the fret is white the contrast may be rather too violent.

When making up fretwork boxes in this manner, a better finish may often be given by allowing the wood of the inner casing *B* to project a little above the edge of the fret *A* of the lower part, the wood inside the lid framing being correspondingly narrow, as shown in fig. 48, which represents the section of the front of a box so treated. When a box has a top without any framing, the wood to which the top fret is fastened may be made to fit within the box, on the edges of which the fretted lid rests, as represented in section by fig. 49. This plan cannot be adopted when the frets are cut in veneers. Many of the published designs for boxes may often be improved by having mouldings planted on at the bottom. When this is intended, the margin of the frets should be left an extra width. The mouldings at the corners should be mitred, and if desired, small round knobs be fastened on underneath to serve as feet. Another way is to shape thin pieces of wood with the fretsaw, and fasten them by glue at the corners under the mouldings. These feet may take a variety of shapes and add considerably to the



FIG. 48.
SECTION
OF FRONT
OF BOX.

appearance of the work. The moulding should to some extent harmonise with the size of the box and of the parts of the fret. To use a heavy moulding with a small box or fine fret would be out of character. Unless there is some good reason to the contrary, even when the design does not show it, it will be better to thicken up the lid,

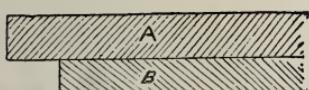


FIG. 49.
SECTION OF
FRETTED TOP.

or, as is technically said, "line" it up. This is not necessary when the lid is provided with a rim. The "lining," as will be seen from the sectional drawing of a flat lid, fig. 50, consists of pieces of wood glued under the edges and not of any great width. They may project as shown, so as to form a moulding, which may be of any suitable design. Even when the fret is stuck on to another piece of wood these lining strips may be used, and by their aid the edges of the box below may project, as in the case of a rimmed lid. They also serve to give sufficient thickness to the lid to allow of the screws in the hinges having a good hold. It is important to notice that the grain of the lining strips at the end of the lid should run in the same direction as that of the lid and of the back and front strips. When two surfaces are glued together the grain of both should correspond. In the case of a box or other article where the ends are fastened, attention to this is not of such consequence as it is for doors and flat lids, such as those just alluded to.

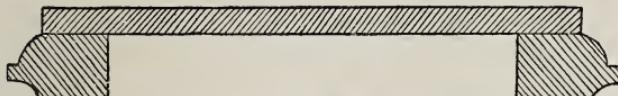


FIG. 50. FLAT TOP WITH RIM.

A more fancy appearance may be given to boxes by lining them inside with silk, velvet, or some other material, and a few remarks regarding these and the way they may be used will not be amiss, remembering that many of them are applicable not only to boxes, but to many other articles, or even as a backing for any kind of fretwork.

Paper may be used as a backing, but there are obvious objections to it.

Cardboard is somewhat better than paper, but only by reason of its increased strength, and it should be used chiefly in conjunction with silk or plush, or similar fabric. As the treatment of these is similar, they may be considered as one. In the case of a delicate fabric there would be great risk of injury from the paste or glue coming through, and there is the difficulty of getting the edges nicely trimmed without liability to fray. This may be avoided by knowing how, and taking a little care.

Let both sides of a piece of card be covered with the velvet or whatever is being used. If the edge of the fabric is turned over just sufficiently, so that its edge is covered by the margin of the fret, all unsightliness is avoided. When speaking of velvet in connection with fretwork the finer kinds of silk plush are referred to, for the coarser Utrecht or mohair velvet used by upholsterers for covering furniture with is not so suitable. To stick the velvet to the card use glue, which should on no account be put on the velvet, but on the card. Cover the card with it, then press the velvet down gently, and no harm will result. Separate pieces of card should be used for the different pieces of the box, and the bottom one need only have one side covered, even if it is necessary to use card at all.

Done in the way indicated the inside of the box is plain or smooth, but an additional effect may be given by quilting and padding. This is not so suitable for velvet as for silk or satin. Cardboard is used as before, only instead of the covering being glued on all over its surface it is only fastened at the edges, which are turned over on to the side which is next the fret. The padding is got by using a little cotton wadding. This will give a plain padded inside to the box, and if it is desired to have it quilted sew through the silk and card at regular intervals so as to pull the wadding down tight at the stitches. To prevent these being visible, small buttons may be used to cover them, or tufts of silk, or anything of that kind. Small buttons or nails with split shanks are obtainable, and stitching may then be dispensed with, as the shanks are driven through silk and card and turned over behind. Whether quilted or plain padded, the back of the card, *i.e.*, the side which fits against the fret, must be covered with a piece of silk, the edges of which must be glued down in such a manner that they will be hidden by the margin of the fret. When using this plain silk it is better not to stick it down all over, as if delicately tinted the glue might injure it, and there is no necessity for fastening it except at the edges.

When it is desirable that the contents of a fretwork box shall be partially visible and yet be protected from dust, the lining of the inside, except the bottom, of course, may be of glass. This is not a material which is commonly recognised as suitable for the purpose, but in such cases as that named it may be used with advantage. The upper edges should be ground smooth and polished.

Gilded backgrounds to frets may sometimes be used with advantage. Entire frets may easily be gilded. Of course, anything intended to be finished in this way need not be made in any choice wood, common pine will do instead and answer just as well.

Among the sundries are odds and ends of brass and metal work, such as hinges, locks, escutcheon plates, etc. These things are much smaller than similar articles used for ordinary purposes, and they are not generally to be obtained at cabinet brass workshops.

Hinges occupy a prominent place in making up work, and may be treated first. In fitting them, whether to doors or lids, it is of importance that they should be not only neatly but accurately fitted. If clumsily fastened they do not look well, and if they are inaccurate it is impossible for the door or lid to work nicely. The kind used most commonly is the butt hinge, and the fretworker will seldom have occasion to use any other. We may say that nothing sets off work so well as good brass-work, whether in hinges or anything else. The appearance of an otherwise well made and finished article is greatly lessened by the use of inferior qualities.

The size of the hinges must depend on the work to which it is applied. Practically any length may be used, but the width of the plate should very little exceed the thickness of the *edge* of the wood to which in most cases one of the plates has to be fixed. Possibly both plates may be fastened to edges, in which case if there is any difference in their thickness the hinge will be determined on by the thinner one. The joint of the hinge must project beyond the wood for very obvious reasons, so that this excess should be allowed for.

In order that hinged parts may fit closely together, the hinge plates must be sunk in the wood. When the plates occupy the full thickness of the wood this may most conveniently be done by running the saw across and neatly cutting away the wood between the kerfs with a chisel. Both hinge plates may be let into one

of the pieces, or one into each of them, according to circumstances, of which a few particulars may be given in order to guide the worker. For all practical purposes it will be sufficient to consider that the ordinary butt-hinge is to be used in connection with doors of cupboards and lids of boxes.

When a door is hung it may be either within the ends top and bottom, or covering the edges of these parts, in which case it is, except for its upright position, to be regarded as a flat lid of a box. For the present it may be supposed that it is to be hung within the ends, this being the arrangement most commonly met with. Occasionally designs indicate the other, but it will generally be better to alter the construction. This may be managed in most instances by either making the case or cupboard large, or by reducing the margin of the fretted door. The hinge may be sunk either in the edge of the door or in the end of the cupboard, or partially in both of these parts. So far as actual utility is concerned it hardly matters which plan is adopted, though for convenience and in order not to increase work unnecessarily the hinge should be sunk in the edge of the door, unless there is some decided reason for adopting one or other of the alternatives. The grounds of preference for the course recommended may be stated, as the worker will to some extent be aided in knowing when to make a departure from it. Speaking broadly, the reason for adopting it is merely convenience and the reduction of the work of fitting to the minimum. It must be evident that it entails less work to cut a piece out of the edge of the door than to do so inside the end of the cupboard, and it is equally clear that no object can be gained by sinking one hinge plate into each portion. This is generally done, and is better, because if the heads of the nails project above the plate, as they often do slightly, they are not in the way of the door closing without straining the hinge. The best way to proceed when hingeing is as follows: Mark out the position of the hinges on the door edge. If the plates are not wide enough to occupy the whole thickness, mark their width on the edge. Saw across and remove the waste. If the hinge is a long one, one or two additional saw-cuts may be made between the two outer ones to facilitate the work of the chisel without tearing the wood irregularly. Open the hinge and screw down, or if the size is too small to allow of screws being used, small wire nails may be substituted. In almost all doors there are at least two hinges, and as a rule no more are necessary. Whatever the number, they should all be fixed in the same manner, and it will be necessary to see

that the pins or wires connecting the plates are in the same straight line and that they project equally. The hinges being on the door, put this in its place, open with the loose hinge plates as nearly as possible in their proper positions against the end. With a bradawl, pencil, or other sharp point, mark or bore one hole for each hinge in the wood, through a hole in the hinge plate. Then fasten with screw or nail as before. Then try if the door hangs satisfactorily, opening and closing easily. If it does, complete the fastening up of the hinges. Should it not, remove the one screw already inserted through each hinge and try again. The reason for only using one screw or boring one hole for each hinge is that alterations may be more accurately and easily made than if each hinge were fastened completely.

For similar reasons to those given for sinking the hinges in the doors when these are within the ends, the hinges will be sunk on the ends of the case when the door is hung outside them, and this applies equally to boxes with flush lids.

When boxes have tray or rimmed lids the hinges may be sunk in either part, or partially in both. A very easy and expeditious mode of adjusting them is to temporarily fasten the two portions of the box together, open with one or two clamps, the edges being flush with each other. The saw can then be drawn across, or if the box is too small to allow of this being done the chisel can be used instead. The waste wood is then removed and the hinges fastened as before. Instead of the ordinary butt-hinges being used for boxes, when it is desired to prevent the lid opening out, the

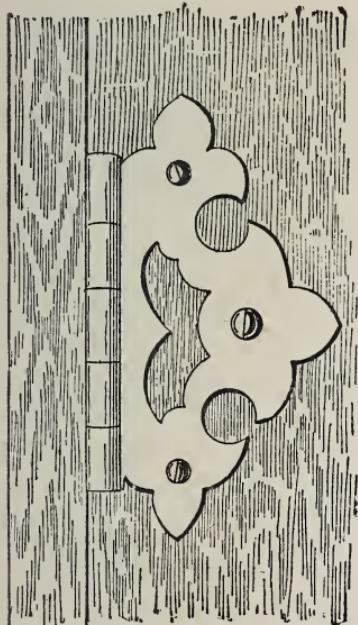


FIG. 51. ORNAMENTAL PLATE TO HINGE.

“stop butt” should be chosen. In details of fixing it is the same as the other, but a peculiar formation of the joint prevents it being opened beyond a certain distance.

A variety of hinge is that with ornamental plates for showing on the exterior of the box or door, but the directions already given will enable anyone to fix them. Usually they are simply screwed on and not sunk into the wood. Much the same effect may be obtained by using the ordinary butt and fixing on ornamental plates close to them on the outside of the work, as suggested in fig. 51, which represents a portion of a door so treated. Hinge plates for this purpose are to be purchased, but may easily be prepared by the fretcutter himself. They look best when fastened on with round-headed screws of the same metal as themselves.

Small doors may often be hung without hinges, as these are ordinarily understood by driving pieces of wire or pins through the top and bottom of the cupboard. Both pins must be in the same straight line, and if the door fits well the outer edge must be rounded to give clearance.

Second only to hinges in importance are locks and various kinds of catches for keeping lids and doors close. These are made in considerable variety, and many of the latter kinds of fastenings are very handsome in appearance. They require no special directions about fitting beyond that this should be neatly done.

Locks are usually constructed so that they require to be let into the edges of doors and the fronts of boxes. Care must be taken in doing so not to cut away too much of the wood, but to leave sufficient for the nails or screws which are used to fasten the lock in its place. Occasionally the wood may be too thin to allow of any or sufficient being cut away. In this case it may be advisable to thicken up the part where the lock is to lie, glueing on a piece of sufficient size and thickness behind the fret. The cutting of the keyhole needs considerable care. The chief danger to guard against is that of making it too large. To avoid this it will, when first making a keyhole, be better to err in the other direction and make it too small. The size can easily be increased by filing. As it may not always be possible to avoid making an unsightly keyhole in the wood, it will be satisfactory to know that there are such things as metal escutcheon plates. These have keyholes in them and they are not only useful for hiding badly cut holes in the wood, but they are ornamental in appearance. If the hole in the plate is not sufficiently large to pass the key, it is not a difficult matter to file it larger.

Many kinds of locks are sold with, and are only usable with, plates for the bolts to shoot into or catch in. The relative positions of the lock and plate are of importance, and must be adjusted

carefully to each other if trouble afterwards is to be avoided. The usual way is to fit the lock first and then adjust the plate to it. Another variety of lock is that in which the bolt shoots into an eye projecting from the plate and fitting into the lock. In this case the operation of fitting the plate is considerably simplified, as it is only necessary to fix the lock, put the plate on it when "unlocked," and put the lid down to ensure the exact position being marked. The plate is then to be sunk flush with the surface.

In another kind of lock for cupboard doors and for drawers a plain bolt is shot forward on the key being turned.

A few words on the construction of doors will not be out of place. It is seldom that a fretwork design shows that the door is to be framed and panelled, in most cases a plain piece of wood behind the fret, or the fret itself forming the door. This method may do occasionally for very small doors. In the majority of instances it will be better for the fret to be glued on to another piece of wood to form a backing to it. If the door is only small a plain piece of wood will do very well, and it may answer even for a large one, though in this latter case there is some risk of the wood not remaining flat. To avoid this as much as possible the grain of both the fret and the backing should be in the same direction. If one is horizontal and the other perpendicular, not only is there a great chance of the door twisting or curling, but of one or other of the pieces splitting. To make the job a perfect one from a joinery point of view the door ought to have a frame and panel fitted flush within it on the side to which the fret is applied. To make a door neatly in this way requires some good joinery, so that if the fretworker is not equal to the task he should get a cabinet-maker to do what is necessary for any article which is valued.

CHAPTER XII.

WORKING IN METALS AND XYLONITE.

ELTHOUGH the general principles on which brass and other metals as well as other hard substances, such as mother-of-pearl, are cut are precisely the same as those for wood and the ordinary soft materials, there are several additional points which must be observed in order that the work may be accomplished with comparative ease. Without such precautions it would be almost a hopeless task to attempt metal cutting, for the smallest trial will convince anyone that the treatment must be modified. Articles are seldom made entirely of fret brass or metal, but such things as hinge plates, escutcheon plates, and overlaid parts, may often be constructed by the fretcutter.

That comparatively thick metal may be cut with the saw is not to be denied, but it will easily be understood that the thicker it is the greater the difficulty in working it, and for all practical purposes it may be considered that metal of the thickness of that of a shilling is the maximum. In most cases considerably less will suffice, and the sawyer may be advised to use it as thin as he can. For metal cutting we, as a rule, prefer the hand frame to the machine, but when this is used the speed at which it is worked must not be great. It is, however, almost impossible to give precise directions as to this, for "circumstances alter cases," and occasionally it may be quite practicable to run the saw at a fair rate of speed.

Perhaps the easiest way in which thin metal can be worked is by fastening it between two pieces of soft wood, such as pine. This offers little resistance to the saw, but keeps the metal from bending, as otherwise it is certain to do, to the annoyance of the worker and the destruction of the blades. The wood and metal

are to be kept in contact by nailing through the waste pieces of the design, which is of course drawn on the upper piece of wood. As the saws, when metal is being cut, require frequent lubrication, the best way to provide for this being done is to insert well greased paper between the brass and the wood. Two sheets, one on each side of the brass, may be used. If more than one piece of metal is being cut at a time, a piece of greasy paper should be between each of them. Of course the alternative, and it is a clumsy one, of greasing the blade as the work proceeds may be adopted if preferred, and is the only one which is practicable when one sheet of metal is being sawn without wood.

As the principal object of the wood is to keep thin metal from bending or springing under the action of the saw, it follows that when the metal is of sufficient thickness to be rigid no wood need be used. Automatic lubrication may then occasionally be managed by the substitution of a sheet of thin greased cardboard for the wood and paper, but we cannot say that we altogether approve of this plan, though it is sometimes practised. As the worker will probably soon find out if he tries it, there are several objections to it, and if any temporary backing is used with the metal, wood in almost every instance is to be preferred to anything else.

When the metal is sufficiently thick to be cut alone, a difficulty may occur in transferring the design to it, for it may be concluded that the novice will not care to scratch or engrave the outlines of the design on it. The simplest way is to stick paper on the metal and then trace by means of carbon paper, as suggested in a former chapter ; or, of course, if preferred, the design, either the original or traced, may be stuck down. The adhesion with either glue or paste may not be perfect, but with ordinary care it will be sufficiently good to enable the cutting to be done. The design may also be transferred direct to the metal by means of carbon paper. If the surface is rough no preparation may be necessary, but when the lines cannot be got otherwise there will be no difficulty if the following plan is pursued. Coat the metal with turpentine and wait till it has dried on. There will then be a good surface for the design to take on. When this has been accomplished no further directions as to cutting will be required, but the edges will probably need some attention from the file afterwards in order to get them as smooth as they should be. After the brass or other metal has been finished as well as it can be, it may be either silver or nickel-plated at a small cost. If it

is to be left in its natural colour it may be protected from tarnishing by coating it with lacquer. This is to be obtained ready made from any oil and colourman, but one sufficiently good for the purpose may be made by using ordinary French polish, which, as is no doubt well known, is a solution of shellac in methylated spirit, made thicker by the addition of more shellac. To use either this, or indeed any lacquer, the metal should be polished as brightly as possible and must be free from every trace of grease. The metal should then be warmed and the lacquer painted on with a soft brush with a quick motion, care being taken to avoid going over the same part twice. If after all the lacquer should be lumpy or ridgy, it may be removed either by washing with spirit or with strong soda and water and the process be repeated *de novo*.

Metal mountings may either be fastened to their supports with nails or cement. In many cases the appearance of the former would render them objectionable, though occasionally by the use of nails with suitable heads they may be made an additional means of improving the appearance of the article to which they are added. When an adhesive has to be used glue can hardly be considered a suitable one, though we have sometimes found that Le Page's liquid glue does well enough, especially in conjunction with a few small nails or wires, which can be filed off level with the surface. A better and more reliable means of adhesion is shellac cement. This is sold at many tool shops in the form of small sticks and is used very much as sealing wax, to which it is akin. In order to prevent it hardening quicker than is desirable the metal to which it is applied should be warmed, but in spite of this precaution the adhesion may not be perfect. If there is any defect in this respect a remedy may often be found in the application of a warmed flat-iron to the metal, with which it should be left in contact till cold. Care must, however, be taken that the iron is not so hot as to melt the shellac to such an extent that it is all pressed out from between the parts it is intended to connect. A liquid shellac cement is of easier application, especially when comparatively large surfaces have to be stuck together, as it is used much in the same way as glue. It may easily be made at home, as it is nothing but a strong solution of shellac in methylated spirit. No special remark is necessary about its application.

While on the topic of cements other than glue or paste, it may be well to direct attention to the peculiar treatment necessary

when pieces of xylonite are to be fastened together or to wood. Glue alone will not do, as it does not adhere when cold to this material, from which it flakes off. The best cement we have used for the purpose is that prepared and used by the manufacturers of xylonite for making up their own articles. It is not usually an article of sale, but can be obtained from the manufacturers in liquid form, either transparent or opaque white. For general purposes we prefer the former, but whichever is used the treatment is the same. If the two pieces to be joined are both xylonite, they should be brushed with the cement, which appears to some extent to act as a solvent, and then brought into close contact and forcibly kept together till the cement has hardened, which will not be long. If they can be pressed together with a hot caul or some substitute the adhesion will be closer, but this is not always practicable. If the xylonite is used as an overlay on wood, in most instances the cement need only be applied to the former, but somewhat more thickly than when both surfaces are cemented. Should the adhesion not be sufficiently strong, it will be owing to the wood being so porous as to absorb more than its share of the cement, and in this case the usual preparation of sizing the wood may be resorted to, or weak glue may be applied to those portions which will be under the fret. If the wood has been French polished before the xylonite is laid, only the cement applied to the latter will be necessary, as it causes a perfect adherence, while ordinary glue, as is well known, does not adhere thoroughly to French-polished surfaces.

CHAPTER XIII.

POLISHING, STAINING, AND BLEACHING.

ELTHOUGH French polishing is a trade by itself, it is only reasonable to suppose that most amateurs will wish to finish their work themselves without having recourse to a professional polisher. The difficulties in the way of polishing, either by the method known as French or the simpler wax and oil polishing, are by no means great, so that few need be deterred from finishing the work themselves. To say all that might be said about the polisher's craft is of course out of the question and altogether beyond the intention of the present directions, and it must suffice to give general hints, which, however, ought to be sufficient to enable anyone to accomplish what is necessary in a satisfactory manner.

Although there are several methods by which wood may be polished, *i.e.*, have a gloss given to it, the finest is that known as French polishing, and when properly done there is none better. The appearance of most woods is improved by polishing, which not only brightens them up, but brings out the figure, as it is said, by strengthening the contrasts between the various markings. The only exceptions to the rule that woods are improved by polishing are in the case of white woods, such as holly, which should be left unpolished.

French polishing, as is no doubt well known to the majority of our readers, consists in coating the wood with a thin varnish specially prepared for the purpose and applied in a peculiar manner by rubbing instead of brushing or painting on, as in the case of ordinary varnishing. The polishing varnish, or simply French polish, as it usually called, leaves only a thin film, almost an imperceptible one, on the wood, and is further rubbed till it

shines. Such in outline is the principle of the process, which, however, cannot be applied without further directions as to the preparation of the wood, etc. The French polish itself can be bought ready prepared, but it may easily be prepared by the user. Various ingredients are sometimes used in making up the polish, but the best is the simplest, and consists merely of shellac and methylated spirit. The proportions may vary, but about 6oz. of the former in a pint of the latter forms a very good general polish. It is only necessary to mix the two in a bottle and leave till the lac is dissolved. The process may be slightly hastened by occasional shaking, and considerably so by the application of heat, which, however, we cannot advise unless the utmost caution be used, on account of the inflammability of the spirit. The polish may be either brown or colourless. In the former case the ordinary shellac is used, and in the other white or bleached shellac. For most kinds of wood brown polish does well enough, but where great purity is required the white alone should be used, and it may be satisfactory for those who do not care to keep the two kinds by them to know that the white polish may be used for any kind of wood. The only, or at any rate the chief, objection to it is that it is slightly more expensive than the other. The quantity that will be required by the fretcutter is so small that this consideration need hardly weigh with him.

Some woods, such as mahogany, walnut, and others which it is desired to darken somewhat, are usually oiled, the oil used being raw linseed.

It is rubbed in with a pad or rubber of cotton wadding enclosed in a piece of soft rag, or with a piece of rag alone. The wood should not be saturated, and the oil should be allowed to dry before the polish is applied. Were this to be done at once there would be a considerable waste both of time and material, owing to the quantity of polish which would be absorbed by the wood before any would be left on the surface. It is, therefore, customary to use a "filler" of some kind to stop up the pores of the wood, and though this may not be necessary with some of the closer grained varieties it is never detrimental to them, and must be used with coarser kinds, such as oak, mahogany, and walnut.

One of the best fillers is ordinary whitening mixed to a paste with turpentine, and another popular one is a mixture of the same, or plaster of paris with tallow. As may be imagined, the former is the pleasanter of the two, but whichever is used it is rubbed into the wood so as to fill the pores. When using a filler of this

kind the difficulty is that some of it gets over the edges of the frets, and particularly into the corners, whence it is a matter of considerable trouble to remove it entirely. On this account it is often considered preferable to fill in with polish alone. To do this takes a good deal of time with some kinds of wood, and the following method is often practised with success. The piece of fretwork is fastened to a board and flooded with spirit varnish, which may be made by thickening ordinary French polish with resin or additional shellac. The varnish sinks into the wood and not only varnishes the edges of the holes, which it is out of the question to try and polish in the ordinary way, but stops the grain of the wood and so acts as a filler. The surface of the wood is then rubbed over with fine glass-paper just sufficiently to remove inequalities of the varnish, which, of course, must be thoroughly dry before the paper is applied. Instead of fastening the fret down and flooding it, the varnish may be applied with a brush and then, as before, rubbed with glass-paper. The grain of the wood having been filled by any method which is preferred, the polish may be applied, and the real art of the work consists in the way this is done.

A small rubber of cotton wadding covered with a piece of soft linen or cotton rag from which all stiffening in the shape of starch or sizing has been previously washed is made up in such a way that the bottom, or portion which comes in contact with the wood, is smooth and without creases or folds. A little polish is put on the wadding, the covering replaced, and the moisture equalised by pressing the rubber in the palm of the hand. The rubber is then with gentle pressure passed repeatedly over the wood till dry, and the operation is repeated as often as may be necessary to get a good body of the polish distributed equally on the wood.

When using the rubber, care must be taken that it is not made too wet, as all that is wanted is a slight moisture. If the rubber sticks and does not glide easily over the wood a very small quantity, the merest touch, of oil may be put on its face. It is also necessary not to let the rubber catch on the points of the fret and cause breakage. To lessen the risk of this happening, it is not a bad plan to put a coin, such as a penny piece, above the wadding, which forms a more rigid pad than it otherwise would do.

After a sufficient body of polish has been put on and allowed to get hard, the next part of the process is the final one of "spiriting off." This requires great care, for it consists in rubbing over the surface as before, but this time with a rubber charged

with spirit only instead of polish. The object of the "spiriting off" is merely to remove the smears and dulness left by the polish rubber, the spirit with which it is moistened partially dissolving the surface of the body of shellac. It will easily be understood that this is a delicate operation, for if the spirit rubber is too wet, or too much spirit is used, all the body may be washed away instead of merely caused to shine brightly.

A much easier way of bringing the gloss up, or rather of imparting a gloss, is by means of a preparation called glaze, which, like polish, can be bought or be prepared by the user, applied to a surface which has been already "bodied in." It can be applied either with a sponge or a soft rubber made as before, but made fairly wet and drawn lightly once or twice over the wood instead of being smeared on in all directions. The effect is almost instantaneous, but the gloss is not so durable as when obtained by spiriting. Still, for many purposes, and especially for articles which are not much handled, it does almost equally well, while from the comparative ease with which glazing can be managed it may be a question whether the result is not better for amateurs than when spiriting is not done in the best manner. Spiriting requires considerable practice, while with ordinary care glazing can be done successfully with little or no preliminary practice. Glaze is made of gum benzoin and methylated spirit in varying proportions, according to the fancy of the user. Our own practice is to about half fill a bottle with the gum, which should be crushed, and then fill up with methylated spirit. The gum will dissolve, and the mixture must be strained through muslin before use.

It is often considered desirable to polish the wood before cutting it, and then many of the difficulties incidental to the polishing of fretwork are removed, and we certainly advise the novice, even if he does not make a practice of doing so, to polish a piece or two before fretting it. He will then gain useful experience more easily than otherwise, and will be able to polish frets more satisfactorily. He can use the filler first spoken of instead of varnish, and it may be well here to say that a white filler is usually coloured to match the wood to which it is applied. The exact tint, however, is not of much importance, and a little rose pink for mahogany or reddish woods and vandyke brown for walnut and the brown woods will be all the colours required. If the wood is polished beforehand, it is unnecessary to proceed further than the bodying in before fretting, leaving the final

spiritng or glazing to be done afterwards. There is no practical reason why the polishing should not be finished at once, but whatever care is used when cutting, it will be necessary to go over the wood afterwards to remove scratches, etc., so that this "touching up" and the final spiritng or glazing may as well form only one operation, in order to save time.

As the edges of frets cannot well be polished unless they form long curves, the best way to finish them is varnishing them carefully with a brush, special care being taken not to clog the corners. Owing to the difficulty of finishing edges they are often left untouched, or at the most only oiled if they look too light in colour when contrasted with the surface of the fret.

What is known as dull polishing is effected by first polishing the wood, as already described, and then removing the gloss by means of little fine emery or pumice powder lightly rubbed on with a stiff brush, of which the strokes should all be in one direction.

Another method of getting a dull polished surface is by means of the old-fashioned wax polishing process. This is very easy, but takes time, as the gloss is obtained almost entirely by friction and a small quantity of a wax paste, or, as it is generally called, "wax polish." This is made by melting some ordinary beeswax, and while still hot stirring in sufficient turpentine to form a stiffish paste when the mixture has become cold. Every polisher has his own ideas about wax polish, some preferring it in a liquid form, while others going to the opposite extreme use only the smallest quantity of turpentine, so that the novice can hardly make a mistake when there is such a variety of opinion among professional polishers. As will have been gathered, we prefer the polish to be in the form of a paste, but this is entirely a matter of fancy and custom. The mixture, a small quantity only of which is required, should be rubbed on with either a brush or rag, and the scrubbing continued till the polish comes up. Excessive rubbing can do no harm—indeed, if we may so express ourselves, the aim of the wax polisher should be to rub off all the wax he has previously put on.

Wax polish is peculiarly adapted to oak darkened by fumigation, mahogany, and walnut, but is not so suitable for fine choice woods, such as olive. Edges may be sufficiently wax polished by means of a piece of waxed rag wrapped on a piece of stick of suitable size to fit into corners.

Simple oiling is sometimes resorted to instead of either wax or

French polishing, and when a dead dull effect—often a very charming one—is desired it is very effectual. By continual rubbing, a gloss almost equal to that of French polish can be got on an oiled surface, but the process is such a tedious and prolonged one that this is seldom done. When work is either wax polished or oiled, it is not advisable to do so before fretting the wood, especially if the design is stuck on to the wood, as the moisture in the paste or glue will remove all the gloss. This does not apply to French polish, to which, by the way, the paper will not adhere so firmly that it cannot be removed without the aid of the scraper.

As all work should be in parts when it is polished, it may be well to say that the polish must be scraped off joints to be glued together, as glue does not hold well on polished surfaces. If the articles are made up before polishing, as they ought to be, the fitting should only be of a temporary character, for if the parts are permanently made up, there will be a difficulty in polishing corners cleanly through the impossibility of getting the rubber in them. The polish will accumulate in such parts, giving them, to use an expressive trade term, a treacly appearance, or it will leave them untouched. Neither of these is a desideratum.

As every one who reads these lines no doubt knows, a light wood is often stained to imitate, at any rate so far as an approximation to colour can do so, a superior or darker wood. Now, as far as fretwork is concerned, we cannot advise the amateur to attempt staining for the following reasons, apart from the difficulties which he will generally meet with in the way of colour, etc.:—If the wood is stained before cutting, the staining is only superficial, and the edges will, after the fretting has been done, show the natural colour of the wood and require to be separately stained. On the other hand, if the staining is deferred till after the fretting, the liquid of the stain is apt to raise the grain of the wood, and sink more deeply at some parts of the edges than at others. As suitable wood can be got in such a variety of colours, either natural or dyed through, we recommend the amateur not to stain more than he can help. As, however, it is not always convenient to be unable to stain or match up the colours of two pieces of wood which may not be of the same colour, it may be useful to know how to treat them occasionally. To darken mahogany, solutions of either bichromate or permanganate of potash are very useful, the strength of the solution depending on the intensity of the stain required. For darkening oak and making it resemble brown oak, the solution of bichromate of potash is very good.

For a brown stain, nothing is better than a mixture of vandyke brown and liquid ammonia diluted with water, as may be desired. It must be noted that after the application of any liquid stain the roughness caused by the moisture must be rubbed down with fine glass-paper, care being taken not to remove so much of the surface as to show the natural colour below, and neither polish nor varnish must be applied till the wood has become thoroughly dry.

So far, particulars have only been given for staining by means of liquids applied to the wood, but there is another process, known as fumigation. As this is done by the vapour of ammonia, and the wood is not touched by liquid, the grain is not raised, so that there is no objection to fretwork being darkened by this method. The woods which are chiefly treated by fumigation are oak and mahogany, for while others may be influenced by ammonia vapour, many undergo no change when subjected to it.

To darken wood by fumigation it is only necessary to put the pieces in a box, which, when closed, should be as nearly air-tight as possible, along with some strong liquid ammonia in a saucer or shallow dish. The wood should be so arranged that the vapour has access to all portions, and as the grain is not raised it should be cut first. Any box may be made sufficiently air-tight by pasting strips of paper over the joints and where the lid fits. The quantity of ammonia cannot be stated exactly, as so much depends on its strength and the size of the box, but the quantity of wood which may be stained at a time has little or nothing to do with it. It is therefore from an economical point of view desirable to stain as many pieces as the box is capable of holding at one time. If left in the box for a few hours, say, for a night, the colour of the wood will be perceptibly darker. If it is not dark enough then, it must be re-enclosed with some fresh ammonia, and so on till the depth required has been obtained. In order to watch the progress of the fumigation the box may have a piece of glass let into any part to serve as a window, but as it is sometimes difficult to see the wood, or rather its colour, we prefer the following plan, which we do not think has been published before. A hole is bored in the lid or any convenient portion of the box with a large gimlet or small bit. A stick of wood of the same kind as that to be fumigated is cut to fit tightly in the hole, a portion of it being projected through to the inside and enough left on the outside to allow it to be grasped and withdrawn. As the fumigation proceeds the progress can easily be ascertained by pulling the stick out and noting how the portion within the box has darkened.

A prolonged examination will not be necessary, but if desirable the hole can be temporarily closed by pressing a finger over it. In any case the escape of the vapour will not amount to much. Woods that can be darkened by ammonia may be left for a few days in a stable instead of treating them with the vapour.

Instead of darkening wood it is sometimes requisite to lighten its colour. There are several bleaches which have been recommended for this purpose, but for general use none of them is better than a solution of oxalic acid in water. As this is a deadly poison, care should be taken to keep it under lock and key.

As it may be presumed that the fretcutter will make use of xylonite, a few directions about polishing it will not be amiss, as it requires entirely different treatment from wood. Small pieces may be polished by rubbing with a mixture of oil and pumice powder till all roughness and scratches are removed and then rubbing with whitening either dry or with a very little oil till sufficiently polished. Any of the powder which gets in the corners or elsewhere may be washed away with water and a soft brush without injuring either the fret or the polish. The process is rather a laborious one, so it may be satisfactory to know that the British Xylonite Company, 124, High Street, Homerton, do not object to polish amateur's work at very reasonable charges, and as they have special appliances for the purpose they naturally get a better finish than can be obtained otherwise without much labour. It may be interesting to state that the polishing is effected by means of calico wheels revolving at a high rate of speed, aided by pumice powder, whitening, and oil, so that those who have access to similar wheels or can fit them up can do the work for themselves.

CHAPTER XIV.

INLAYING AND MARQUETRY.

INLAYING one substance with another or with one of similar material is, compared with ordinary open fretwork, distinctly an advance. Inlaying cannot be done satisfactorily till proficiency has been attained in ordinary plain fretsawing. To a certain extent the processes are the same, but inlaying of whatever kind is more difficult than the other. It is not to be understood that the difficulties are so great that only a few specially skilled experts can manage inlaying of any kind, for there is no reason why anyone who can saw fairly well to any outline should not be able to do even the most elaborate and difficult form of inlaying ordinarily known in this country as marquetry. At the same time we cannot too strongly impress upon the aspirant to facility in inlaying or marquetry work that unless he can manipulate the fretsaw easily and accurately he need not hope to succeed, practice and knowledge are necessary. The former depends on himself. The latter we hope to impart, and we must caution him that with one exception, so far as we know, all the purported guides to marquetry work are either so vague as to be almost useless, or extremely fallacious. The fact is that marquetry-cutters have been in the past, and to a certain extent still are, extremely jealous of allowing anyone to become acquainted with their methods of work, so that there have been unusual difficulties in the way of giving practical directions to those who could not learn directly from one of the craft. The same secrecy was maintained by fretcutters in this country till comparatively recent years. When we see the degree of proficiency to which amateurs in fretwork attain, it seems not unreasonable to suppose that they might succeed equally well with marquetry if they only knew how. If they attempt to do this kind of work according to

the directions generally given, it is no wonder that they soon give it up in disgust under the mistaken notion that it is beyond their capacity. If rightly taught there is no reason why marquetry should not be practised more extensively than it is, for it cannot be considered much, if at all, more difficult than another favourite pastime, wood-carving, while to many it will be much easier.

On the respective merits of the two arts, wood-carving and inlaying, or rather that form of it called marquetry, we do not intend to enter, but those who have paid little attention to the latter can be but faintly aware of its claims for recognition as a means of artistic recreation. For decorating furniture and interior woodwork, with the exception of carving, there is nothing more appropriate or beautiful. We are now referring to marquetry or inlays made up of variously coloured pieces, but in a less degree the remarks apply to plain inlays of only two colours or materials, and the way in which these are formed must be first described. The directions on plain inlays are specially given for beginners, or rather for those who are able to do ordinary fretwork but are not acquainted with inlaying procedure, while the directions for cutting and making up marquetry may be studied with advantage by all who wish to become proficients in this beautiful art. There is no reason why ladies should not, by turning their attention to marquetry-cutting, extend the number of artistic pursuits open to them and if need be turn it into a means of increasing their income. They will find it at least as profitable as wood-carving; the work, even when pursued as a source of income, can be done at home, for it is not customary for marquetry-cutters to do their work in the factories or shops of those whom they supply. If we may venture a few words of advice to those who wish to supplement their incomes in this manner, we would say that they should not ask more than the ordinary trade remuneration. Our own experience of the ideas of amateurs, or quasi-professionals, is that their work is either not up to the mark, or that they have exaggerated notions of its value. As we are giving them a little piece of advice, may we also say that it is not good policy to introduce themselves and their work to a manufacturer's notice by informing him that somebody, who probably knows nothing about it, has told them that their work is worth so and so much. The best way is to let the work speak for itself. Marquetry-cutters who can design or adapt given designs to suit special shapes and sizes will stand a much better chance of getting employment than others. The

shapes and sizes of the panels, etc., as well as of the design, constantly vary, so that "stock" panels are little or no use.

Before giving directions for making up marquetry, simpler forms of inlay must be dealt with, as they are not only necessary but will to a certain extent pave the way for it.

CHAPTER XV.

PLAIN INLAYING.

THIS may be as well to explain here that there is a species of so-called inlaying which is formed of geometrically shaped pieces in which the fretsaw plays no part. Familiar instances of such work are chess or draught table tops, in which each piece is in the shape of a square. These are not included in the marquetry-cutters operations. What we have to do is to explain how fretwork may be inlaid, or, to give a more extended definition, how inlaying, in connection with which the fretsaw is the most important tool, may be managed in the most workmanlike manner. In case this last remark may seem somewhat out of place in a book specially dedicated to amateurs, let us hasten to explain that those methods which are adopted by the workman, or professional artisan, will in any craft be found in the long run not only simpler but better in every way than mere makeshifts.

The simplest kind of inlaying is that in which two pieces of wood are fretted at the same time, so that the pieces which have been cut out fit either into the wood of which they originally formed part, or into the other which was cut at the same time. Thus, if a piece of white wood and a piece of black are cut at the same time the portions which have hitherto been waste can no longer be regarded as such, forming, as they do, a very important part of the inlay. They are the pieces which are inlaid, so that they cannot be regarded as being secondary, even to the pattern, which in plain open fretwork has been the only part of the wood to be preserved. If the pieces cut from the white wood are laid in the openings they must fill them as well as they would those in the pieces from which they came, and *vice versa*. Two inlays are thus obtained—one of them a white ground with black inlays,

the other a black ground with white inlays. There is thus, so far as pieces are concerned, no waste, but there is the same kerf to be compensated for, the wood removed in the form of sawdust being the only waste. This will be referred to later on. The chief differences in manipulation when cutting ordinary fretwork and that which is to be inlaid must be considered.

The first thing is the necessity of avoiding injuring the pieces cut out. In them, when waste, the holes for the saws could be drilled in the most convenient place, and of any size, and the saw could cut through them in any way. All that is altered now, for neither holes nor saw-cut must be allowed to show in the pieces to be removed. Both must be on the line of design, and there can be no running into waste to facilitate turning corners, etc. To begin with, then, the drill used must be no larger than is absolutely necessary to allow the saw to pass through the hole made by it. The blades themselves should also be as fine as convenient, so that a much finer drill than there is any occasion to use in ordinary fretwork will be required. The hole that must be made with it being on the line of the design should be placed in some part where it is least likely to be conspicuous, for however fine the drill may be and with whatever care it is used it is not possible altogether to prevent the hole being seen.

As small drills are very fine, they must be used gently to prevent them being broken, for the same amount of pressure must not be applied to them as to coarser kinds. If the drill breaks in the wood, it is sometimes an awkward matter to remove the broken piece. When the broken pieces cannot be withdrawn the best way is to bore a fresh hole elsewhere, and on the saw reaching the broken bit to work as close round it as possible, almost as if one were endeavouring to saw through it. The teeth of the saw will probably suffer, but this will be better than spoiling or blemishing the work. When using a fine drill, care is necessary to withdraw it; as the metal of which the drills are composed is very highly tempered and consequently brittle, they must be drawn out straight. Any attempt to ease them by working them sideways will certainly break them. As it is sometimes difficult to meet with very fine drills, it may be well to suggest that the broad flattened parts can be rubbed down on an oilstone. In doing this care should be taken not to injure the sharp edges of the facets. A bradawl ground down to a very thin tapered edge may be sometimes used to make an entrance for the saw.

When the blade is in, extreme regularity in sawing is necessary, as it is quite impossible to correct any deviations from the line by filing or trimming them up true.

Although the saws used should be as fine as convenient, there is no necessity for the finest only, say the 00 or 0, being considered suitable, for the grades numbered 1, 2, or even 3 do not make an excessively wide kerf, and for most work will do very well. It may be wondered why we do not advise the use of the finest saws made, and our reasons are that the finer grades are more difficult to use than those which are comparatively coarse. The difficulty of doing the work is great enough any way, and there is no use in increasing it unnecessarily. Certainly the finer the blade the smaller the cut, and consequent close-fitting together of the parts, but an absolutely tight fit is not necessary in most work. To be perfect theoretically, no doubt the pieces should fit quite closely, but practically there is no occasion for them doing so. In determining what space can be allowed, or what the width of kerf may be without destroying the beauty of the work, many circumstances must be taken into consideration, and it is not possible to state definitely what will suit each case. It must therefore be sufficient to give such general limit or suggestions as may enable the learner to decide for himself.

The distance at which the finished inlay will ordinarily be from the observer when it is fixed in its destined position is not to be ignored, and may be taken as the first matter to be considered, for a joint between two pieces could not be so clearly seen at even a short distance as if examined closely in the hand. The majority of fretwork articles, all of which it may be assumed come under the heading of inlaying, are not subject to very minute scrutiny unless for purposes of special examination. There is, therefore, no occasion to waste time and increase labour by using the finest saws. On the other hand, there are some articles in which fineness and the highest degree of finish are essential, unless they are to miss the intention of their maker, and on these no amount of care can be considered excessive.

The thickness and hardness of the materials being sawn must also be taken into account, for no one would think of sawing, or attempting to do so, through two thicknesses of $\frac{1}{4}$ in. stuff with a No. 0 blade. It is very rarely that anything much thicker than veneer is used for inlaying, but there are articles which it is sometimes better to inlay in comparatively thick stuff, as, for instance, the handles of paper-knives. Even when veneers or

material such as metal, mother-of-pearl, etc., of no greater substance are to be cut, it may be necessary to take their hardness into account.

One point, and it is one which is very apt to be overlooked, in determining the width of the cut is the fact that the glue which is used to stick the pieces together and the subsequent operations of cleaning up materially tend to close the joint, and if not rendering it invisible at least prevent it from looking conspicuously wide. This is especially the case when either the ground or the inlay is black or dark in colour, for two light woods used together require more attention in this respect.

At present we have considered the saw as cutting perpendicularly to the wood, so that even were a dozen pieces of veneer being cut through, there would be no difference whatever in the sizes of the pieces removed. Those from the top veneer would fit equally as well into the bottom one, as the pieces from it would fit into the top. The pieces, therefore, may be considered as interchangeable with each other, *but* there must be the space of the thickness of the saw open between them, of course, till it is filled up as suggested with glue. It will thus be noticed that there is no waste whatever of the pieces of veneer, however many of them are cut, for each piece can be utilised. With this remark, which we will ask the reader to keep in mind, we proceed to show how the pieces are to be cut when it is desirable that the parts shall fit tightly.

Impossible as this may seem when the necessity of allowing for the saw kerf is remembered, it is yet remarkably simple. All that is necessary is to saw on the bevel instead of perpendicularly, *i.e.*, to give the sides of the cuts a slanting direction instead of a square one with the surfaces. When the hand-frame is used this must be done by sloping the saw to one side or the other, but in machines, as the saw cannot be altered in this respect, the same result is got by adjusting the tilting table to a sufficient degree. Herein lies the sole advantage of having a tilting table. Most machines have it, but even with a fixed table there is little difficulty in sawing on the bevel, by interposing a board, gradually diminishing in thickness from one side to the other, between that being cut, which rests on it, and the table. The wood to be cut of course lies at a slope with the saw, and that is all that is required. The convenience of a table which can be tilted is that it can be adjusted to any angle. By sawing round an opening on the bevel it must be evident that the piece cut out

will be bigger at the top or bottom, according to the direction in which the sawing proceeds, and in this lies the whole secret of compensating for the width of the saw kerf. On this principle, if two pieces of wood are sawn through at the same time, the pieces from one of them will fit into the space made in the other. If the bevel has been excessive it will not fit so accurately that the surfaces are equal, while if it has not been enough the pieces will fit loosely but still more closely than they would have done if there had been no bevel. The happy medium is to have the bevel just such that the top piece will quite fill the lower opening—or *vice versa*, as already suggested, it being presumed that both pieces of wood are of precisely the same thickness. In order to prevent any possible misconception, diagrams illustrating this mode of inlaying are given, and it must be explained that they are on an enlarged scale so far as thickness of wood and width of saw kerf are concerned, that the principles explained may be perfectly demonstrated. The wood is represented in section.

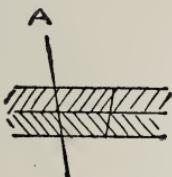


FIG. 52.

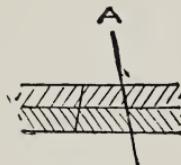


FIG. 53.

SAWS CUTTING ON THE BEVEL.

In fig. 52 the broad principle of cutting on the bevel is shown with upper opening larger than the lower, the saw being indicated by the sloping line A. If, now, we imagine this saw to be vertical and the wood it is cutting to be on the table of the machine, we find the degree to which this is tilted, and that it is inclined downwards towards the right, the saw blade facing towards the operator. Now, keeping the table tilted in the same direction, but with the cutting proceeding in the opposite one, it will be seen that the upper opening is the smaller of the two, as in fig. 53.

By reversing the slope of the tilting table and the saws as shown, opposite results will be obtained, so that the sawyer can tilt it, if it will tilt in both directions as most of them do, to please himself, and make either the lower or upper opening the larger.

The precise degree of slope or bevel must depend both on the

thickness of the wood and on that of the saw. As these will constantly vary in different pieces of work, the inlayer cannot do better than make a few trials for himself. A few experiments, which can easily be made, will, with the hints given, be of more service than whole pages of explanation. When beginning a new piece of work it is always well to test the degree to which the table is tilted on a couple of pieces of waste wood of the same thickness, in order to prevent any mistake.

The work of drilling, sawing, etc., is exactly the same whether done on the bevel or straight, but it is as well to drill the hole at a slope to correspond with that of the bevel.

Now, when the cutting is straight the pieces are interchangeable, but when sawn on the bevel this is not the case, for, supposing the upper opening to be the larger, the piece from it will fit into the opening below, but the piece from this will not fit into the top one. There is, therefore, an unavoidable waste, for the piece cut out of the lower piece of wood is useless. Occasionally, also, the top piece may be waste except for the piece cut out of it and let into the lower one, but often it may be utilised as an overlaid fret, or if thick enough as an ordinary open piece of fretwork. In this respect, therefore, inlays cut on the bevel compare unfavourably with those cut in the simpler manner, for it takes two pieces of equal size to form one inlay.

With ordinary veneers there is no difficulty in sawing through six thicknesses with a No. 1 saw, one colour being that of the ground, and the other of the pieces let into it, or the simplest kind of inlay. Many writers on the subject give minute directions for forming complicated inlays by laying pieces on top of each other either for the same or for separate cuttings, but such directions are not the outcome of practical experience. Whenever an inlay of several colours is wanted it will be much better to adopt the course pursued by all practical marquetry-cutters, which is the only practical one, except perhaps for the very coarsest kind of work, and even then it is simpler and better.

Whenever more than one inlay is wanted of the same size or pattern, each inlay being of two colours or kinds, the facility with which several pieces of veneer can be cut at the same time may be judiciously taken advantage of by placing the veneers in their respective colours alternately. If cut on the bevel the top one is only of use to supply the pieces to fit into the sheet immediately below it. With common cheap materials this may not be of much consequence, and having pointed out the circumstances the sawyer

will have no difficulty in deciding for himself which course to adopt. By the use of five pieces of veneer four inlays will be got, and five sheets are by no means an awkward number to cut through, while if three are cut there will be two inlays. One, or two, as the case may be, of these will be the original, while the others will be the counters or negatives as far as colour is concerned, but not on that account necessarily of less value or beauty. There may be some among our readers who are inclined to think that thick inlays might be cut instead of thin veneers. Well, such a supposition at first sight seems a reasonable one, but further acquaintance will show that thick inlays are seldom necessary, are more troublesome, and of little more utility than the thinner, even when both sides of a piece of work, as, to refer to a familiar instance, in the case of the projecting upright of a bracket. It is only necessary to lay two inlaid veneers, one on each side, on such a piece to give the effect of a piece inlaid right through. This method is far simpler, easier, and less wasteful.

To prepare the veneers for cutting they must be fastened together in some way. One way is to stick the pieces together by means of glued paper between them. We do not recommend this plan, for although it gives a nice solid piece to cut, it is an extremely difficult matter to separate the pieces afterwards without breaking them. With comparatively thick wood, metal, or xylonite, even if thin, this method is as good as any. To fasten the veneers of wood together the best way is to nail them with small wire nails, the ends of which should be turned over to clamp the pieces up, and, of course, must be outside the design. Between each piece of wood a piece of greased paper should be laid, as explained in a former chapter, for though not absolutely necessary such a precaution will be found of great assistance to the action of the saw. If the veneers are large, and therefore likely to spring while being sawn, or do not lie so low and flat as they ought, a few wafers of the common coloured kinds sold by stationers stuck here and there between the sheets will be found useful, as the pieces are afterwards easily separated by inserting a thin knife blade between them. If the wood is dark it can do no harm to put fine wire nails through at any part of the work. The holes they make will be so minute as not to be discernible after the work is finished. Nails to be removed should not be too tightly clinched. As the pieces are cut out they should be laid on one side in some order approximating to their position in the inlay, and every care be taken not to get them mixed up with each other. If such a

mischance as this does happen it will be an awkward one. When working in a special room for the purpose there is not so much risk of this happening as when the work must be done at odd times in the ordinary living rooms of the family. To put the pieces under such circumstances on a tray or board in the expectation that they will remain in their places is almost to court disaster. Several alternatives may be suggested for those who cannot leave the pieces without danger of their being disturbed. One is, make a number of compartments divided from each other by thin wood or cardboard on a board or tray, each compartment being numbered. On the design number the pieces to be cut out, and as they are separated drop them into the compartment with the corresponding number. In this case the design, or a recognisable if only a rough tracing, must be kept as the key to show where the numbered pieces go. Instead of numbering them the pieces may be placed in compartments as nearly as possible in the order of the position they occupy in the design.

Perhaps a simpler method and one which will commend itself to many is to replace the pieces when the cutting has for a time been done. They can easily be taken out again when wanted by putting a board over the work, turning it upside down, and then lifting the fret. If the cutting has not been done on the bevel, of course it is only necessary to raise the fret from the board on which it is assumed to have been laid before the pieces were replaced. By the methods named any ordinary fretwork pattern may be used for inlaying purposes.

CHAPTER XVI.

EASY INLAYING WITH SEVERAL MATERIALS.

HIETHERTO only the simplest kind of inlaying has been mentioned, for the pieces being cut together must fit. We proceed to describe a process of inlaying in which the pieces are cut separately, so that the fit depends entirely on skill and accuracy. If the inlays are to be good, these qualities must have been developed to a considerable extent; it would be mere folly for the novice to attempt this kind of work. It is by cutting the pieces separately that the most elaborate specimens of marquetry are produced. The principle is the same, but the details of work are different and more complicated. If the worker can succeed with the simple method, he will find little difficulty in doing fine marquetry, and apart from its being a good introduction to this, he will find it useful on its own account in making up many little articles of more intrinsic value than plain fretwork.

But, it may be asked, what advantage is gained by cutting the pieces separately? It is a reasonable question, and deserves consideration. When the pieces can be cut together there may be no advantage, that method is chiefly of use when the inlay is of the simplest kind, and even then cannot always conveniently be adopted. There are objections to it—the drill holes, for example. When the pieces are cut separately these do not appear, for they are formed in the waste. Again, it is not always practicable to fasten the different veneers together so solidly as they ought to be, for though the nail holes may not always be visible, they are never desirable, and in many instances amount to a positive blemish. If the pieces are cut separately, there is plenty of space in the waste material for the nails, and wafers or other adhesive substances may be dispensed with altogether. Smaller pieces may

be used to cut the portions which are to be let in from, so that there is little waste. Instead of being limited to two or three colours, the inlay may consist of any number. All the inlays are precisely alike, for there are no counters or negatives. All points and corners can be cut with the utmost sharpness and cleanness without the necessity of using a saw of one of the finest grades. In case of an irregular or faulty line, the pieces can be worked on to rectify any defect, as when plain fretwork is being treated.

As the sawing must be done with accuracy, the designs, or rather lines of the designs, must be identical on the piece forming the groundwork and on those to be cut separately; for if there is any irregularity, no matter how well the sawing may be done, the pieces cannot fit accurately. With great care, designs multiplied by means of carbon paper may be made use of. There is, however, always the danger of paper so applied stretching, and the lines being thereby distorted. This must be most carefully guarded against. The safest way to proceed in such cases is to put the adhesive on the wood, and then press the paper down straight without rubbing it. Wrinkles may rise, and there may be some air bubbles—probably will be. The former, unless excessive, will right themselves as the paper dries, while the latter may be got rid of by pricking them and pressing—not rubbing—the paper down to expel the air. An apparently easier way of getting over the difficulty which may arise from the paper stretching may possibly have occurred to some readers, viz., to lay the paper on the wood, and then trace it from the original design. This does well enough for ordinary work when there are no inlays, but it will require remarkably careful tracing to get all of them exactly alike, so that for all practical purposes this plan is not feasible. In the meantime we may suggest a method which, though we do not know that it has been advocated before, is none the less useful. We have found it extremely so, and can recommend it. It is seldom that only one inlay is required, and when more are wanted the way now recommended is a natural and simple one. When only one is to be prepared, a piece of thin waste wood must be cut along with it. This in any case would be necessary if the inlay is only in veneer thickness, so that is no extra expenditure of material. The thinnest and commonest pine will do as well as anything for the waste piece, the object of which is not only to sustain the veneer, but to allow of a piece of very thin cardboard or stout brown paper being sawn at the same time with the veneer, by being placed between it and the waste. The card must

not be stuck down, and it will be better not to grease it. If there is any occasion for doing so, two pieces of paper or card may be used to form two patterns, but they will not often be required. The thicknesses of wood are to be fastened together as before, with wire nails, and greased paper may be inserted. The fret is then sawn as before, and only ordinary care need be used to adhere closely to the line, as the difficult part of the work will come next.

The thin card or paper will of course be an exact counterpart of the fret as regards the outline, and it is to be used to cut the pieces to be inlaid by. Either the card cut out with the waste, or the repeat of the fret may be used, and which of them must depend on circumstances. It may, however, be necessary to remind the cutter that the saw kerf must be allowed for. This can be managed as follows: If the waste pieces are used, cut round outside them without touching the paper itself, while if the fretted paper is preferred, the saw must proceed just within its edge and not on the uncovered material. The reason for using thick paper or thin card is that it can be stuck down with less risk of altering under the influence of the glue or paste than with thinner paper. Of course if greasy the adhesive will not act well, hence the reason for saying that it should not be used as a vehicle for lubricating the saw.

By adopting this mode extreme accuracy is only needed when cutting one set of lines, that is, those of the pieces to be inlaid, instead of having to be equally careful with all. The risk of getting irregular pieces which will not fit is thus diminished by half. This plan may be regarded as an intermediate stage between plain inlaying and marquetry work.

Ordinary or coarse marquetry may be managed to some extent by the method just described, but when there are a great number of pieces and any of them are very minute or fine and thin the difficulties in the way of doing so are considerably increased and greater than when the ordinary method is adopted. Owing to the liability of veneers to break when the pieces are fine, a special appliance known as a donkey is used in order that the risk may be as small as possible. Even when cutting veneers of any kind with a machine it is desirable that this should have a presser foot to prevent them springing up and getting broken. The saws also must be regulated to a nicety, so that they cut cleanly, without jerking. When a machine has no presser the difficulty may be got over by making use of something which can be held down on

the veneer just behind or close to the saw. Any thin piece of wood a few inches in length and $\frac{1}{2}$ in. or so wide may be used, and if the end be bevelled it will be found more convenient than if simply cut straight across.

CHAPTER XVII.

MARQUETRY INLAYING.

MARQUETRY is inlaid ornamentation of one or more woods or other material, forming either a perfect picture or ornament by itself, the wood in which it is laid being a necessary adjunct, but not forming part of the ornament. For our present purpose, at any rate, this definition will be sufficient and enable a distinction to be drawn between inlaid frets and the kind of inlay now under consideration.

After having become almost a lost art in this country, marquetry-cutting is again coming to the fore. With its increasing popularity the quality of the bulk of the work has, within the last few years, steadily deteriorated in quality, thanks to the constant demand for cheap furniture. How far time will modify or tone down the crude colourings of much of the modern date marquetry, or to what extent it may be credited with the contrary on the good specimens of old work which are in existence, it is hardly for us to say, but we cannot help thinking that many of these latter must have been much brighter than they are popularly supposed to have been when new.

The materials which are used for marquetry inlays are almost entirely veneers, or materials of about the thickness of ordinary veneer. In addition to veneers in the natural colours of the wood, which are to be preferred for the choicest kind of work, dyed veneers in an almost endless range of colours and tints are to be had. They should be used sparingly and only when some effect which cannot be got with the natural woods is wanted, unless the colours of the different pieces are blended with skill and taste. The same care should be used with them as an artist would use in selecting and applying his colours.

For the groundwork of the inlay any kind of veneer may be used, but it is rare to see anything but the natural wood, with the exception of black. The woods most in vogue for the purpose are at present rosewood and mahogany. This latter when fumigated with ammonia or otherwise darkened to the so-called "Chippendale" tint approaches very closely to the former in colour. Walnut, either burr or American, is occasionally used for the ground, but inlays rarely look so well in conjunction with it, and they are not so fashionable. Formerly satinwood was held in high repute, and for delicately tinted and carefully executed work it is unsurpassed, though not much seen in modern work. It is not so suitable for beginners, for it is more difficult to hide bad joints in light than in dark wood.

The necessity of having the lines of the piece to be inlaid and of the pieces to be let into it to correspond exactly need not be further urged. The plan adopted ensures absolute precision, but the preparation of the pattern is a tedious one. It is to prick the whole of the outline carefully so as to form a stencil, by means of which the design may be pounced down on the wood to be cut. The design when once prepared lasts a long time with careful usage, and a large number of pouncings may be made with it. A coarse needle is as suitable as anything to prick the design with, and if it is stuck into the end of a penholder or anything of that kind to form a handle it can be more conveniently used than by itself. If the holes are too fine there is a danger of them getting clogged up with the pouncing powder or not allowing it to pass through sufficiently freely to give a clear outline, formed by a series of dots. If the holes are too large the lines will be coarser than they should be to form a guide for accurate cutting. There will be no difficulty in determining by experiment what suits best. Almost any kind of paper may be used for the stencil, but a hard thin make of good quality is the best for the purpose, and a soft thick fluffy one should be avoided.

If the design has both sides alike, half the labour may be saved by folding the paper down the middle and piercing both at the same time. By this means, also, both sides are got exactly alike without any trouble. The same plan may be followed whenever a design is made up of four quarters. The needle in passing through will form a burr round the holes, and this is apt to prevent clean pouncing. It may be removed by the application of the finest glass-paper.

Simple though the preparation of the stencil pattern may seem,

the novice must not expect to make a satisfactory one at the first attempt. It will therefore be well to practise a little on odd pieces of paper before proceeding to work on a full design.

Many fine powders may be used to pounce with, but for general purposes asphalte is the most suitable material, as when properly treated marks with it are indelible. It is a brown pitchy substance sold in lumps, and must not be confounded with the coarse asphalte used in paving roadways. A small quantity should be powdered finely, and as it is very friable there is no difficulty about this with little more effort than by pinching and rubbing it between a finger and thumb. The powder should then be put in a muslin bag and the pounce is formed. To use it, all that is necessary is to pass it over the stencil, when enough will go through to mark the design on the wood or paper underneath. If left so the design could easily be erased, and if on lifting the stencil it is defective it should be brushed away. A flick or two with a handkerchief will obliterate it. If it looks all right, hold it near a fire or over the gas or lamp till the heat melts the asphalte. It is then practically indelible when cold, and may be handled without fear of injury. It is owing to this that asphalte is so valuable to the marquetry-cutter. Being itself dark it cannot be used on any but light woods, unless they are prepared for it by rubbing chalk or by sticking light paper on them, the latter being the better though slightly more troublesome method. Light coloured powders are sometimes used for pouncing on to dark wood, but the marks are easily obliterated.

As rosewood is an unpleasant wood to cut owing to the resin it contains, its properties in this respect may be improved by heating the veneers to such an extent that the resins or gums are melted and come to the surface, from which they may be wiped off. This need only be done when the wood is unusually refractory under the saw.

Four thicknesses of veneer are usually sawn through at the same time, even though only one inlay is required; but those who may find it as easy to work the saw through fewer or more need not of course be guided by this custom. They are fastened together with small wire nails in the way already described, with pieces of paper smeared with tallow separating the veneers. The size of the pieces must be regulated according to that of the parts to be cut from them, so that there is comparatively little waste, for it is quite unnecessary to do more than mark the particular part of the design to be cut from it on any piece of the veneers.

In arranging these attention should be paid to the direction of the grain of the wood, for in many designs the beauty of the work can either be greatly enhanced or detracted from by this means. With figured veneers, the effort should be to get the markings so that they correspond more or less with the direction of the sweep or curve of the design of which they form the part. To give minute directions on this is of course impossible, as no two pieces of wood are exactly alike in figuring. It is just on such little points that the taste of the worker is displayed. When only one or two inlays are wanted, but for the sake of convenience four of them are cut together, only those which are to be used need be of the special kind required to form the inlay. The others may be of any faulty or common kind, for they are only waste and are simply used to make up the thickness which in ordinary circumstances is found to be most conveniently sawn. The holes are drilled in the waste wood, if any are necessary, for when small pieces are being cut it is often just as easy to saw through from the edge of the wood.

The saws used need not be of the finest kind, for if they cut cleanly little more is necessary, and the grades 1, 2, or even 3 will do very well for most purposes. However, by the time the worker has acquired sufficient skill to cut marquetry he will be able to judge for himself what size blade to use, for even among the best marquetry-cutters opinions differ not only on this but on other details. Use and custom have a good deal to do with it.

In a former chapter reference was made to the saws used by marquetry-cutters. These, as a rule, almost invariably make their own, but it is questionable whether the amateur or occasional cutter would derive any benefit to compensate him for doing so. Preparing the saws is an art in itself, and one not to be acquired at once, so that in learning to do so time which might be more advantageously used might be wasted.

It is noteworthy that different marquetry-cutters make their saws in different ways, to some extent regulating them according to the work in hand. They get accustomed to the saws of their own making, and are more at home with them than with others. It is, however, very doubtful if an amateur, or anyone but a most practised sawyer, could appreciate minute differences of this kind. Many marquetry-cutters do not find it worth while to make their own saws, but use instead the ordinary article of the tool-shop.

If the hand-frame is used for sawing marquetry work a donkey will be almost indispensable in place of the ordinary cutting-board.

Full instructions will be found for making one in a succeeding chapter, as well as a modified form which we have devised for use when a donkey is not convenient. The donkey, we may add, is not kept by any dealer, so far as we are aware, as an article of sale, being either made for or by the marquetry-cutter himself. The treadle machine is seldom or never used by marquetry-cutters, who allege that it is not suitable for the purpose, and that it is more difficult to use than the ordinary wooden frame and donkey. This is no doubt correct in reference to the finest and smallest work, for without saying that this cannot be done on a good machine, such as the Britannia Company's No. 8, hand-sawing is more convenient in many respects and offers fewer difficulties. With work in which the pieces are moderately large there is little difficulty in using the machine, and considerably more than four thicknesses can be cut. Till one is accustomed to the donkey the machine is certainly easier and less fatiguing to the sawyer. The mode of working is as with ordinary fret, more care if anything being used to saw accurately to the line. To compensate for the thickness of the saw-blade it will be remembered that it is necessary to saw within the line of the outer piece of wood or ground of the inlay and on the outside of the lines of the pieces to be let in. Reference to this having been made in a former chapter, the point need not be further dilated on here.

As at first the novice may encounter considerable difficulty in sawing long narrow pieces of perhaps not more than $\frac{1}{16}$ in. width without breaking them, it may be suggested that in thin xylonite he will find a material which will aid him in doing so. It is admirably adapted to the needs of the amateur marquetry-cutter and the finest work can be done in it. As it is tough and has no grain the finest members are not apt to get broken when cutting them. The finest lines can be sawn without danger in this respect, the only limit being the ability of the worker to guide the saw. The work, even the finest, can be done as well on the machine as with the hand-frame, while many effects which cannot be got with wooden veneers are to be got with xylonite by the judicious use of transparent or semi-transparent pieces. These when polished give a peculiarly charming lustre to the inlay not obtainable with any other material. Both wood and xylonite may be used in forming the same inlay, and many beautiful effects may be obtained by doing so. Xylonite is comparatively unknown among marquetry-cutters, except in the form of imitation ebony, but there are great capabilities in it. For amateurs, from the ease with which

it can be worked, we know of no more suitable material, while from an artistic point of view it is equal to any. The "ivory grain," either for plain or engraved inlays in imitation of real ivory, we specially commend. Thicknesses of xylonite are most manageable when stuck together with glued paper instead of pins or wire nails, though these may be used if preferred. Real mother-of-pearl may be sawn through in one thickness more easily than in several, and this also applies to other very hard materials. When more than one thickness is used, as it may be, the pieces are fastened together with glue and paper, and to lubricate the saw greased paper may be put between them and a waste bit of wood, which, however, cannot always be fastened down easily, so that a lubricator cannot be relied on. There is no satisfactory imitation of mother-of-pearl.

When the ground of a panel is dark and the pattern is duplicated to form the complete design, it may often be cut in half, so that both sides are sawn at the same time. This method will be found useful when only one or two inlays of the same design are wanted, as the four thicknesses can be sawn through with a considerable reduction in the quantity of waste. If when sawing the ground into halves the line of the figuring be followed to some extent, the join where they are put together again on the completed work will be scarcely perceptible. This applies with special force to rosewood, for there are often such strong markings in it that the saw cut may be completely lost in them. Thus far only the sawing or cutting of inlays has been mentioned, and a very important part of the work, viz., making up and joining the various pieces with the attendant operations necessary to make them usable, has to be considered and will be found in detail in the next chapter.

CHAPTER XVIII.

MAKING UP INLAYS AND MARQUETRY.

EVERY ingenious way of fitting the various pieces which form an inlay has been devised. It consists of simply glueing the edges of a piece and putting it in its place. Nothing could seem easier, but unfortunately it is only a theoretical method and cannot be worked in practice. If it could this chapter would only be a very short one, for no further directions than those indicated in the above lines could be necessary.

The inlaid veneers, being so thin, are in themselves useless till they are strengthened by being stuck to, or, to use the technical word, "laid" on, a foundation of solid wood. Now it may seem to many that the best and simplest way is to stick the various pieces forming the inlay direct on to the foundation. In some cases this way of proceeding may be possible, but it should not be practised unless there is some valid reason for not following the ordinary course.

In this, the inlay is made up on a piece of paper first and stuck down to it. Any kind will do, and old newspaper is generally used. The paper is glued over and laid on a flat surface, such as a table or bench. The principal piece of the veneer is put down on it, and the others in their proper order are added till all are stuck down, when the whole piece is put on one side till dry. The glue used should be of a kind that does not set or harden too quickly, otherwise the paper may get dry before all the pieces are stuck down to it. We prefer Le Page's liquid glue to any other for the purpose. If desired to retard its setting, a little treacle, sugar, or glycerine may be added, but not to a sufficient extent to unduly prolong the drying. With most glues a very small quantity will suffice. Instead of putting the glue on the paper, each piece of the inlay may have the glue applied to it just

before it is laid, but this is not such a cleanly method as the other. However, it is just for the worker to decide which plan he will adopt, for as far as the inlay is concerned it matters very little how roughly the glue is laid on, so long as it or dirt does not soak into and spoil the colour of any light-coloured wood. The appearance of an inlaid piece of work at this stage is anything but beautiful and is apt to disappoint those who are not accustomed to seeing it till finished. If held up to the light even the joints, or many of them, will look very discouraging, for it will be a wonderful piece of work for any but a most accomplished cutter if they are so close as to be light-tight. Although those accustomed to see inlays in the rough, a condition in which they are seldom seen outside the workshop, could form a pretty accurate opinion of its quality, others cannot do so till the work is finished, when it will present a very different appearance.

If necessary to flatten the inlay, when it is made up and stuck on the paper it may be kept under a weight for a time, but some precautions must be taken, such as placing a sheet of paper between the board, or whatever is used, and the inlay to prevent them sticking if the glue has not quite set.

At this stage of the proceedings the inlayer's work may be said to have ended and that of the cabinet-maker to commence, for in practical workshops all subsequent operations are done by the latter. It may, however, be assumed that the amateur desires to finish his own work.

The inlaid veneers must be allowed to stand idle till the glue has thoroughly hardened, for otherwise there is a risk of displacing some of the pieces. When the veneer is ready, the upper surface, that is, the one uncovered with paper, must be levelled and roughened. This may best be done with a toothing plane, the iron of which is upright in the stock and toothed or notched at the edge, something after the style of a saw. Its action is a scraping one, and the iron should be set so that too much of the surface to which it is applied is not removed, for an inlay veneer will not stand rough usage. The toothing plane is moved in all directions over the wood, levelling those portions which may have been higher than others, and leaving a suitable rough surface for the glue to hold on. In the absence of a toothing plane, a coarse file or glass-paper may be used, but they are neither so quick nor so satisfactory. When this has been done, the veneer is ready for laying on its foundation. It should be good sound stuff without cracks or knots, and when the veneer is down on it, it

should be treated as any other solid piece of wood. The surface on which the veneer is to be laid should be planed level and gone over with the toothing plane or roughened, so that the glue may hold well. In selecting a piece of wood for the foundation, care should be taken that the grain of the wood and of the main portion of the inlay are in the same direction, and not across each other. For very small work this may not be of much consequence. Inlays are treated just as plain wood would be, the rules in one case applying equally to the other, but it must be noticed that inlays should be laid with the caul. To those who are acquainted with veneering processes, the reason for the former being inapplicable will be at once recognised, and nothing need be said about the preference for the caul. As this method was touched on in a former chapter, the following remarks must be regarded as supplementary. The caul may be of the ordinary common wooden kind or of metal. The cauls for laying the inlay are simply two pieces of board of any kind, pine being as good as any, of, say, an inch in thickness and not smaller than the inlay or its foundation which are laid between them. The glue used should be of good quality, and applied hot and not too thick to the board to which the veneer is to be laid. The cauls should in the meantime be heated at a fire to be in readiness by the time the veneer is put on the glued foundation. The veneer wood is then put between the two cauls, and pressure by means of hand-screws or other appliance is brought to bear on them. The heated cauls soften the glue, so that excess is squeezed out from between the veneer and its foundation, as well as any air bubbles, which, if allowed to remain, would prevent adherence and cause what are known as blisters on the veneer. The pressure must be maintained till the glue has set. The veneer is laid with the paper uppermost. As some of the glue may exude through the joints of the inlay and cause this paper to stick to the caul, it is as well to avoid any risk of this occurring by putting a loose piece of oiled paper between the veneer and the caul above it. This can never do any harm. After the veneered wood has been removed from the caul it should be allowed to stand for a day or two untouched before cleaning off the paper and otherwise finishing, in order that the glue may become thoroughly hardened.

The reason that the veneered wood should be allowed to stand for a time is that if cleaned and finished off at once the heat caused by scraping and glass-papering may be sufficient to cause the glue, if it has not become quite hard, to soften to such an

extent that the veneer will rise in places and blisters be formed. Another important consideration is that the glue, still soft, between the joints of the inlay will sink and leave the joints more open than they would otherwise seem to be if the glue filled them. The time that should elapse between laying the veneer and cleaning it off must depend on circumstances, but should scarcely be less than a day or two, and no harm will result if it is considerably longer. In fact, the cleaning up may be deferred for any length of time. When ready, the paper is removed by scraping or with the toothed plane. After it is off, the inlay is seen in better condition than it has been yet. The scraper and sand-paper will be used till it is perfectly smooth and clean, and as the veneer is only thin, it will not stand an excessive amount of scraping or rubbing down with paper. After having been cleaned, blisters must be carefully searched for. They may be apparent both to sight and touch, but they can generally be detected by tapping the surface all over with the handle of a hammer or other tool. If there are blisters, no pains should be spared to lay them, *i.e.*, to stick the veneer down at such parts. Blisters arise mainly from two causes, viz., either air between the materials, or from the glue having been pressed away at such parts to such an extent that there is not sufficient to cause the veneer to adhere. In the former case, the air may be allowed to escape by pricking the blister. This is then pressed down by a heated hammer head, or other piece of iron, which acts as a small caul, and melts the glue underneath sufficiently to cause adherence. If the glue has become quite hard and parted with all its moisture it will not become adhesive. In this case it must be damped by a little water pricked through the veneer, or it may be possible to make a cut in this, so that a little water can be put through the cut. If the glue has perished, the only way is to cut and raise a small portion of the veneer so that fresh glue may be inserted. From the trouble involved in laying blisters, it will be seen that it is better to avoid all chance of them occurring by exercising care beforehand.

If the inlay has been well cut and all the parts fit closely together it may be considered as finished. But it is very probable that some of the joints are open, and even that some small parts may be missing altogether, and will require filling up. Any unusually wide spaces should have been filled up when the veneer was laid on the paper, but the course of procedure is the same, and the explanation has been purposely deferred till now in order that

the whole of the work may be gone over in an intelligent manner. Before, it might have been probable that the novice would have overlooked the important part that the glue plays in filling up joints.

One favourite method of stopping or filling such places is to use a mixture of white glue and saw-dust of the colour required, and for general purposes it is a very good one. The mixture, which should be composed principally of the saw-dust with only sufficient glue to make it stick together, is rubbed into the places to be filled. It should be left for a time for the glue to dry, and in doing so it will shrink, so that if levelled off at once it will be below the surface of the work.

Another kind of stopping, of special use to fill up the place of missing bits of the inlay, is a kind of sealing-wax, which can be brought in various colours. It is, however, easily prepared. A very small quantity will suffice. The best stopping is made by melting shellac, and mixing appropriate colours with it, the colour depending on that of the wood in lieu of which the stopping is to be used. The shellac stopping before it cools should be worked into sticks, similarly to sealing wax, as in this form it is more conveniently used than in irregular lumps. A good stopping for ordinary purposes, and one very commonly used, is made with shellac, or resin for cheapness, and a small quantity of beeswax melted with it. The proportions vary, and are always mixed by rule of thumb. The mixture is coloured as before indicated.

To use these stoppings, a small quantity is melted into the places required with a piece of heated iron and is as hard as it will be as soon as it has become cold. Wax alone is sometimes used as a stopping, but it cannot be recommended on account of its softness.

Although glue does very well to lay veneers of wood with, it is not satisfactory with metals or with xylonite, as it does not stick properly to them. If the pieces of metal, etc., are only small and fit tightly, nothing more may be necessary, but if they form the entire inlay, or any considerable portion of it, they require special treatment.

Metal should be quite free from grease, and as it is generally used only in small quantities, Le Page's glue seems to do very well for laying inlays of which the bulk is wood. Ordinary glue may be rendered useful for the purpose by mixing some powdered resin thoroughly with it. In special cases it may be necessary to raise the metal and lay it gradually with the melted shellac.

Xylonite requires an altogether different treatment, for glue does not answer so well for fastening down permanently as the

special xylonite cement, though often used. It should be brushed thinly on the xylonite. The wood may be either thinly-coated with the same and the two surfaces brought together before the cement has set, which, owing to evaporation of the solvent, it soon does, or with glue. When properly done, the firmest join is made by the former method, but the latter is quite sufficient for all ordinary purposes, and is the only one which is practically available when the inlay is partly of xylonite and partly of wood, for though we have used xylonite cement with wood instead of glue, we are unable to state whether it will be permanently satisfactory.

It is not, however, used, so far as we know, to any extent by marquetry-cutters, possibly only because they are not acquainted with it, and our own use of it has not been sufficiently extensive to warrant our unreservedly recommending it in lieu of or as a substitute for glue. Hot cauls are used with the cement as with glue. Many marquetry-cutters use only glue even with their ivorine (xylonite) inlays, but we do not consider this satisfactory as the adherence of glue when dry to this material is anything but firm. While speaking of xylonite cement it may be well to say that when coloured with shavings or sawdust of xylonite it forms the best stopping for this material. It must, however, be used with care and not be worked over the surface more than can be helped. As it shrinks considerably in drying, it may be necessary to make two or three applications to those places which are to be stopped.

In order to show their beauty fully and to make them appear to the best advantage semi-transparent substances, such as tortoise-shell or imitations thereof, should be laid on a white foundation, or at least on one of a light colour. As it is not always convenient to use a white wood for this part of the work, some other means of doing what is necessary must be resorted to.

White glue may be mixed with plaster of paris, powdered chalk, or whiting till it is sufficiently opaque to disguise the natural colour of the wood, or the surface of the wood may be whitened by chalking it over before applying the glue. When the bulk of the veneer is transparent, this method may often be adopted with advantage. An alternative is to glue a piece of white paper or calico between the inlay and the foundation. It is of little or no consequence whether the whole of the ground under the opaque portions of the inlay be white or not, but when only small pieces are to have a white backing it is often more convenient to apply this locally than to be at the trouble of whitening the whole of

the surface of the ground on which the veneer is laid. The easiest way in such cases is to glue or cement white paper or calico direct on to the pieces of inlay which is to be backed with white. If it encroaches on other pieces it will do no harm, so that great accuracy in cutting the paper is not requisite.

It may occasionally happen that a piece of veneer has to be laid on a curved ground, and it would hardly do to allow the novice to remain in ignorance of the plan to be adopted, although we certainly advise him in such a case to secure the services of a skilled cabinet-maker accustomed to such work in preference to attempting it himself. A caul may either be made to fit the curve of the panel to be veneered—but unless a considerable number have to be done this is generally too troublesome—or a bag may be made large enough to go over the work and filled with sand. This makes a flexible caul which adapts itself accurately to the curves of the panel, and is used hot as if it were wood. To tighten or press it against the work, pieces of wood may be placed on the outside and then be tightly bound round with cord or webbing. As the circumstances under which the caul is used are constantly varying, it is impossible to do more than give general directions, but remembering what the caul is for, a little ingenuity will enable most of the difficulties which may be encountered to be overcome.

Xylonite veneers present little difficulty even when adapted to curved surfaces, as they can be bent approximately to shape by heating them prior to laying.

CHAPTER XIX.

SHADING INLAYS, MAKING AND LAYING STRINGINGS.

THE important part played by shading and the way it is done have yet to be mentioned. Although many inlays are finished without any parts being shaded, when judiciously done shading much increases the artistic quality of the work. A rich appearance which is wanting in unshaded inlay is given to it, but more time and care are wanted to enable the highest effects to be achieved. Even with ordinary fretwork designs, when judiciously done very fine results may be accomplished, and that,



FIG. 51. WALL BRACKET.

too, without the use of more than two colours, one for the ground and the other for the inlay.

In order to illustrate this we take an ordinary simple piece of fret design and show how a really beautiful piece of inlay may be elaborated from it. If the reader derives the benefit we hope he will from these suggestions, they will enable him to overcome the

difficulty so often felt of getting more than a limited number of designs specially for inlaying. There are a good many of these, but nothing like the number for ordinary fretwork, so that in making the present remarks we are really showing how almost any of these may be treated for inlaying purposes, whether plain or in several colours.

The German and Italian designs which have been referred to elsewhere are adapted for use by the inlayer. The former are generally preferable when bold, strong effects are wanted, while



FIG. 55. PORTION OF DESIGN FOR INLAYING.

many of the latter are of extreme delicacy. We refer, of course, particularly to the ordinary fretwork designs which are not specially named as being prepared for the inlayer's use, our wish being to show how they may be developed.

Our specimen, fig. 54, is taken from a fret workdesign published by Messrs. H. Zilles and Company, in whose catalogue it is numbered 704-706. The article from which the portion on which our remarks are founded consists of a wall cabinet.

The particular piece of fret chosen as our text is the bottom centre one, immediately under the cupboard portion. Reduced in size and to bare outline, little more than the half being shown, as no more is necessary to explain our meaning, it is as represented

in fig. 54. As a fret it looks very well and is equally suitable for a plain inlay of one colour for the ground and another for the pattern. Let us see how it will work out if more colours are wanted. This can be managed by keeping what may be regarded as the main scroll the same as the top and end margin of one colour, so that the

FIG. 56. PORTION OF DESIGN FOR INLAYING.

stencilled outline for it will be as shown in fig. 55. Another piece will be recognised in fig. 56, and if desired the portions of it may be further subdivided, as shown in fig. 57. The small conventional leaves springing from the upper edge of the bottom of the scroll are shown in figs. 57 and 58. The centre piece connecting the scrolls, fig. 59, may very appropriately form another separate piece, and the same may be said of those portions above and below it, the latter terminating in a kind of conventional flower. These will readily be recognised in figs. 55 to 62. The whole of these put together will make up an inlay of ten parts for the half-design, without counting in the ground pieces, as shown in fig. 63, where the joints can be clearly discerned. In judiciously assorted tints or colours it will be seen that a handsome piece of inlaid work has been evolved from the comparatively crude plain fret design. Still all the colours are flat,

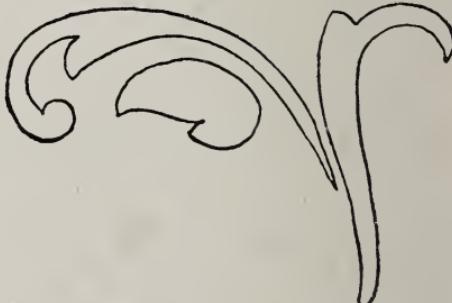


FIG. 57. PORTION OF DESIGN FOR INLAYING.

and it can be still further improved by shading the pieces, as suggested in fig. 64, p. 145. The darkest portion of each shaded part, it will be noted, terminates in a joint. Such shaded work need not be in colours, for very fine effects can be got by simply shading pieces formed all of one kind of wood. For this none is better than box, though all light sorts may be treated in this manner. The shading is lost on a dark wood.

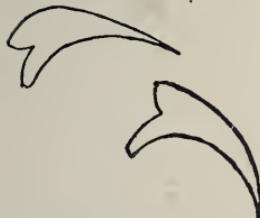


FIG. 58. LEAVES OF SCROLL.

slightly altered, it is done by means of engraved lines, as shown. For ordinary wood inlays the former is generally used, while the latter method is employed for ivory and metals, as well as occasionally on wood.

The hot sand method, as being of the widest application and the most suitable for the inlayer, will first be described. Any kind of sand will do for the purpose. It should be heated over a fire or gas stove, and be kept while in use on a tray or metal dish of some kind. The object is to get the sand so hot that it will brown or darken a piece of veneer stuck into it but not hot enough to burn or char the wood. Thus, on a light wood absolute black cannot be got and is not wanted. The pieces to be shaded are to be stuck into the sand with the edges to be darkened downwards, and must be withdrawn occasionally in order that the progress of the shading may be noted.

In fact, it may be said that they should never be left alone, but be constantly withdrawn and reinserted to get a finely graduated browning.

Care is necessary not only to get the shading well graduated but to get all the pieces to the same tone. A pair of pliers or

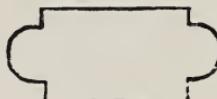


FIG. 59.



FIG. 61.



FIG. 60.



FIG. 62.

tweezers will be useful to save the fingers when shading small pieces. When the heat of the sand can be accurately gauged the pieces may be stuck in and left till the sand gets cold, but we do not recommend this method for fine work, nor yet as suitable for the beginner. The pieces must be shaded before the inlay is made up, for it cannot be done afterwards, though a very close imitation may then be done by using transparent water colours or stains. Indian ink with a brown tinge given to it by vandyke

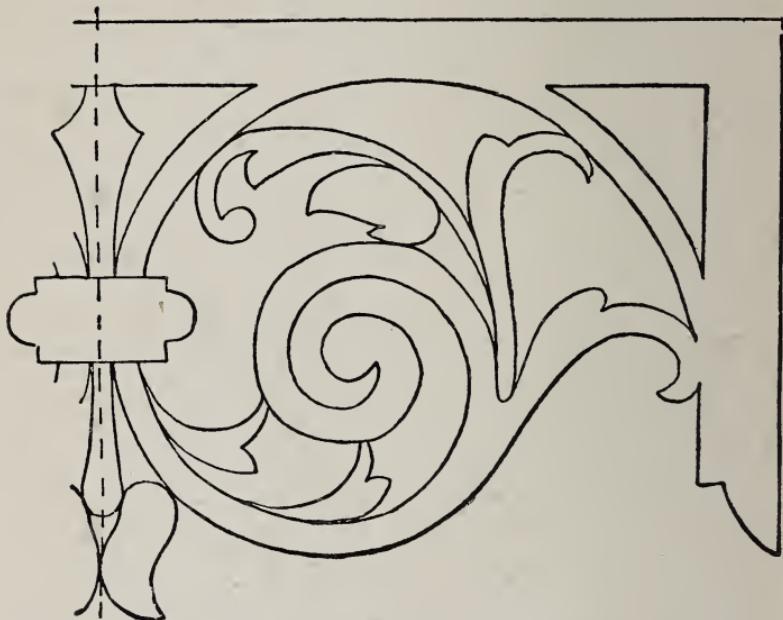


FIG. 63. PIECES MADE UP IN UNSHADED INLAY.

brown or other suitable colour is very useful, and defective sand shading may often be improved in this manner. An ordinary camel-hair paint brush is used to apply the colour with. Plain white inlays may be tinted in imitation of coloured work, but the objection to this is that the colours, as they do not sink deeply, are apt to be rubbed or scraped away when cleaning up the work. Anything that is intended to be painted, either wholly or for shading, should be finished, so far as scraping and rubbing smooth with sand-paper, before using the brush. If the water causes the

grain to rise it may be gently smoothed down with the finest glass-paper. The brush should be kept as dry as it well can be and not be over-charged with water.

The other method of shading, viz., by engraved and blackened lines, is more work for the engraver than for the inlayer, who will probably spoil the inlay. Unless the lines are clearly and regularly cut they will do anything but improve the work. The lines are formed with the ordinary graver used by wood engravers. As wood

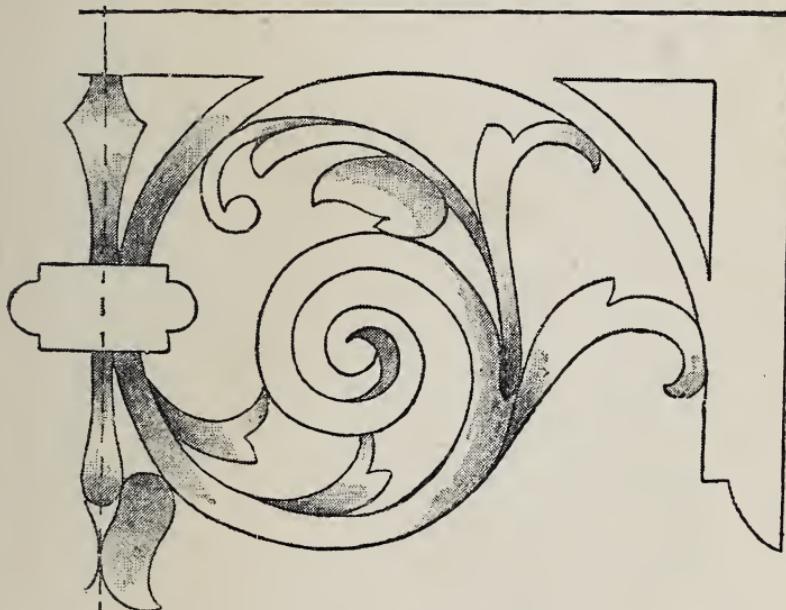


FIG. 64. INLAY SHADED WITH HOT SAND.

engraving is beyond our province, it must suffice to recommend those who are desirous of doing this part of the work themselves to refer either to a practical manual on wood and metal engraving or to take a lesson or two from some engraver. Before the engraver touches the inlay it should be laid and cleaned up as far as it can be, that is, finished all except the final polishing. Many methods have been advocated for blacking the engraved lines, but none is better for general purposes than that of rubbing heel-ball on. Any that adheres to the surface of the work can be

removed by glass-papering, leaving the black lines clear and sharp. Xylonite cannot be shaded by hot sand.

By the judicious use of shading many excellent effects may be got on designs which are otherwise unimportant, as, for example, figs. 66 and 67, which represent very simple lines, both plain and shaded for purposes of comparison ; either is very suitable for a border. In concluding this part of our directions we would recommend the

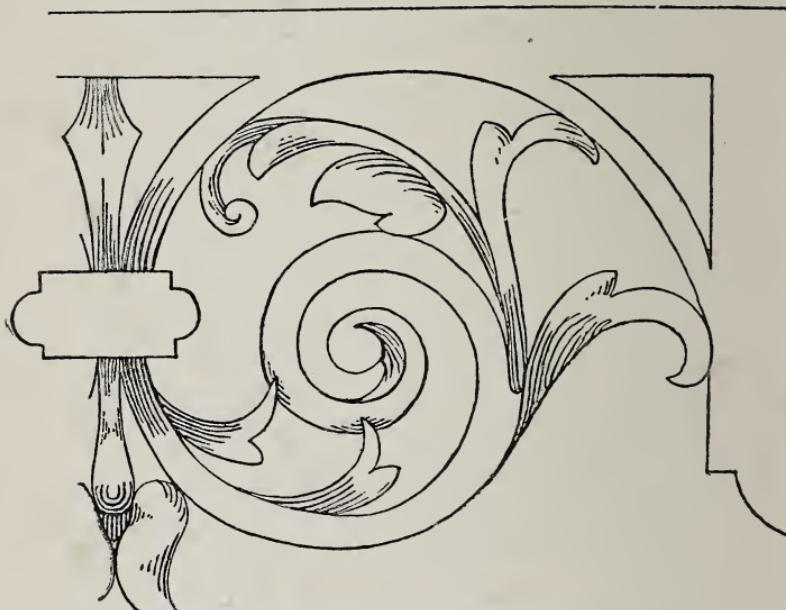


FIG. 65. INLAY SHADED WITH ENGRAVED LINES.

would-be inlayer to remember that after the mechanical difficulties have been overcome, excellence can only be obtained by study and the application of artistic faculties. Inlaying is as much an art as music or painting, so that instructions cannot take the student further than a certain point.

There is, however, a branch of the work which must not be overlooked. We refer to the stringings or bandings which are often found round or near the edges of panels, the centres of which are inlaid with marquetry or are even left plain, as in the

case of table tops, drawer fronts, etc. The stringings or bandings are plain in the majority of good work, the bandings of mosaic inlays being left for small fancy knick-knacks of a cheaper kind. Stringings, however, are very effective when judiciously introduced and not overdone. They are simply straight pieces of veneers, and to be obtained ready made in various widths. All that is necessary is to cut off the lengths either with a sharp tool or

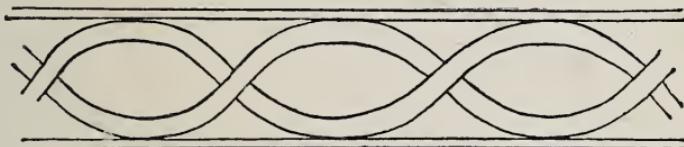


FIG. 66. UNSHADED INLAID BORDER.

knife guided by a straight edge, or to use the ordinary cutting gauge to do so. When several lengths of precisely the same width are wanted the latter is the better way, especially if the pieces are of a fair width. If very narrow the former way of cutting them will be found easier. They may be let into the wood afterwards. To do this spaces or hollows must be cut to receive them, and the fretsaw is of no use for the purpose. The easiest way, and one as satisfactorily as any, is to cut them with the scratch or router. A cutter with a square end and of suitable width must be used, or if a very wide banding is to be let in, one wider than can be readily scratched, it may be more convenient to use the cutting

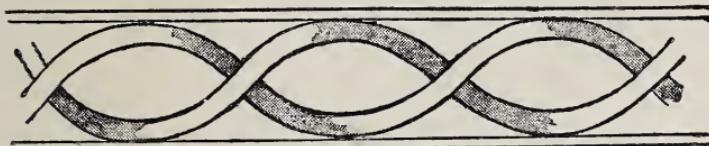


FIG. 67. SHADED INLAID BORDER.

gauge to cut down on each side of the intending banding and to remove the wood between them to the required depth with a chisel. The banding is then to be glued down in its place. Instead of using just one width of stringing, a more finished effect may often be given by using a comparatively wide piece in the centre, and on each side of it one or two thinner pieces. The number of combinations of this kind is practically endless.

It is sometimes necessary to lay marquetry in solid wood. In this case the pieces to be let in are sawn as usual, but the spaces for their reception must be cut or incised as in carving, in fact they may be considered as carved incised lines filled up with coloured veneers, and among professionals the work is the joint production of the carver and of the marquetry-cutter.

In our next and concluding chapter will be found a description of a marquetry-cutter's donkey, together with hints how to use it.

CHAPTER XX.

THE MARQUETRY-CUTTER'S DONKEY : HOW TO MAKE AND HOW TO USE IT.

THE donkey, in common with all tools and workshop appliances which are made by the user, is found in many different shapes and styles. This is natural, as each worker has his own ideas of what is best and most convenient, and being entirely made of wood there is no necessity for his not indulging in them. To whatever extent the details of shape and construction vary, the main features remain the same, and it may be useful now to describe what these are in order that the more minute directions which follow may be appreciated and, if considered desirable, altered to suit the user.

The donkey may be described as a seat with a pair of upright jaws forming a vice, within which veneers are held while they are being sawn. As it is necessary that this vice should be instant in action, both in closing and opening, one or other of the jaws must be made so that it springs open or remains so when not in use, and can be closed by means of a string connected with a pedal, on which one of the worker's feet press. By releasing the pressure, the jaws open sufficiently to allow the veneers being cut to be turned round. Perhaps a better idea of the action will be conveyed by saying that the jaws are kept so close that the veneers cannot easily be broken by the saw, being kept rigid, but that they are not so tightly closed as to prevent the material being worked on from being moved to the blade.

The height of the seat is generally about that of an ordinary chair. The length is that which will enable the worker to sit at or towards one end of the seat, and be able to hold the wood being cut in his left hand, and to work the saw with his right. A convenient length is 2ft. to 2ft. 6in. The height from the seat to the top of the jaws is that at which the saw can be most conveniently worked, and may be named as about 1ft. 3in. to 1ft. 8in.

The simplest form of donkey that can be made is shown in fig. 68. A high degree of finish or nice joinery will not in the smallest degree enhance its value from a practical point of view. Although the dimensions of the various parts are named, they need not be closely adhered to, so that any odd bits of timber which are anything near the sizes named may be made available.

The seat itself is, say, 2ft. 3in. long, of $1\frac{1}{2}$ in. stuff, and of any width which the sawyer can sit astride. At the back it is nailed to

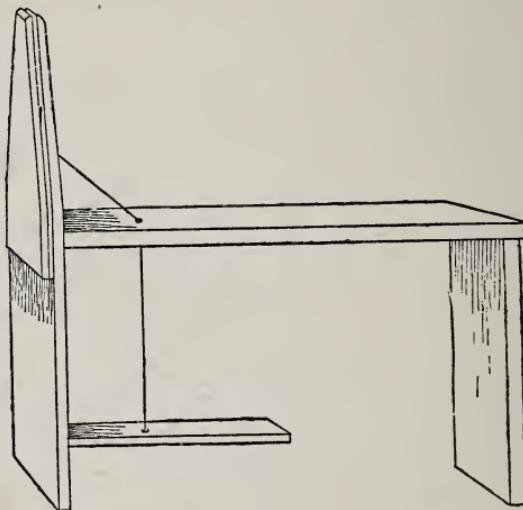


FIG. 68. THE MARQUETRY-CUTTER'S DONKEY.

another similar piece, which acts as the leg there. The front leg is fixed on to the other end of the seat, and its upper end forms the back jaw of the vice. Even if wider at the bottom it should not be wider than 3in. at the top, and it may be considerably less. If necessary, it can be tapered straight from the level of the seat. It, as well as the other jaw, should be rounded off at the top, or if not rounded the top edge should not be more than $\frac{1}{4}$ in. thick. Anywhere on the front of the long leg a block of wood of about $\frac{1}{2}$ in. thick is fastened on, and in the absence of reason for placing it elsewhere it may as well be near the seat, as shown in the illustration of the donkey. This piece of wood gives the distance at which the jaws will be apart from each other when they are

open. On the front of it, again, the other jaw is nailed or otherwise fastened, and the donkey may be considered as made with the exception of the treadle and fittings to close the jaws. Before saying anything in connection with this movement, a few remarks about the piece forming the front one are necessary, as a little more care with regard to it is required than for the other portions. Pine or any other kind of wood will do for them, and might do for it also. It will, however, be well to choose a nice clean piece free from knots or shakes, and preferably of a tough kind, as it must have a certain amount of spring to open again after being released. In order that the resistance may not be excessive when bringing the jaws together, the front one should not be too thick to bend readily on pressure being applied with the foot. The exact thickness cannot be stated, as so much depends on the kind of wood, but it may be about $\frac{1}{4}$ in. to $\frac{1}{2}$ in. The strength of the spring, if too great, can easily be diminished by making a few saw-cuts across partly through the wood or by hollowing a groove across. By this means the degree of spring can be regulated to a nicety to suit the worker.

Now, to set the donkey in working order a piece of wood to act as a treadle is hinged on to the hinder side of the front leg, two or three inches above the floor.

To this, generally through a hole, a piece of string is fastened. This string passes through holes in the seat and both jaws and is secured by a knot in front—the string, which should be strong, being regulated to such a length that when the jaws are open the loose end of the treadle is a few inches from the floor. Only a slight pressure with the foot is necessary to depress the treadle, and in doing so close the jaws, which will hold anything placed between sufficiently firmly to allow of its being sawn. If necessary the seat and legs can be rendered more rigid than they may be if simply nailed together, by fastening stays or struts between them. Simple and roughly made as it is, the donkey described is a thoroughly practical, useful article, and anyone who could not do marquetry-cutting with its aid could not do so with one of more elaborate construction. The chief advantages of such a donkey are that it is simple and easily made, extremely light, and portable, in fact, the smallest that can be made, and the cost is merely nominal. On the other hand, there are disadvantages, or what may be considered such, for whether they are or not depends a good deal on circumstances. The possible disadvantages are : unsteadiness if the seat and supports are very narrow, no table

part or bench on which the pieces can be laid down as they are cut, and that the size of the work held in the jaws is limited by the position of the string. The first one may be overcome by widening the legs at the bottom by glueing a piece on to each side, and tapering it upwards towards the seat. The absence of any convenience on the donkey itself for holding pieces on merely necessitates having a table or a chair near the worker, and it is not likely that any piece of work will be done requiring greater space than can be got above the string.

A few suggestions for making another donkey will not be amiss for the benefit of those who want a superior and more convenient one, though, as has been stated, it will not be more conducive to better work.

If space is wanted to serve as a table on the donkey itself, the seat portion instead of being a plain piece of straight plank must be jointed up to get the necessary width. This may be anything, but unless the donkey is to remain in one place it should not be so great as to be unwieldy, and more than 2ft. may be regarded as superfluous. The chief extra space which will be available as a table will be in front of the jaws, and it may be convenient to put a rim round the edge there, to prevent things falling off.

At the back the board should be narrowed to form a convenient seat, and the leg or support there may either be as before, or of a more ornamental shape.

The front leg, or legs, if two are preferred in front, will in a donkey of this size be independent of the jaws, which will be fixed by mortising and tenoning into the top at a convenient distance from the worker, as before described. It may also be a convenience to have them a little towards the right hand instead of in the centre, in order that the sawyer may not be cramped in his movements when working. Instead of the string going through the jaws and the front one of these being the movable one, a different plan is adopted. The string simply moves in a direct line, and, as before, is fastened to the piece of wood for the foot at the bottom. At the upper end, however, it is fastened to a piece of wood, the bottom of which is hinged to the seat, the top resting against the hinder jaw. On depressing the treadle the upper end of this sloping piece is forced against the jaw, causing it to close up against the front one. Jaws made in this way will take work in as far as the seat.

Mention was made in a former chapter on the utility of sawdust for stopping purposes. In order that enough may be easily

secured and saved, many marquetry-cutters have a small tin trough fixed near the top of the front jaw; the sawdust collects in this as it falls. A similar convenience will be found in having a V-shaped notch in the top of the jaws.

Now, in using the donkey it will be seen that as the wood is held perpendicularly the blade cuts horizontally, and those who have learnt to do ordinary fretwork with the positions of the wood and of the saw reversed will find the action very irksome. This awkwardness, however, will soon wear off, and the advantage of being able to saw without stooping over the work will be appreciated. A minor advantage is that sawdust does not collect nor require to be blown away from the surface, as it falls directly it is made. The saw may be used to cut downwards or in any direction from the right, as the jaws will allow. The blade of the saw may be fixed either to face to the left of the frame or to the front, as under ordinary circumstances.

Now, for those who do not care to use a donkey, either from an objection to learn the altered style of sawing, or from want of space, we have devised a kind of cross between it and the ordinary cutting-board. Like the former, this appliance holds the veneers, and like the latter, it can be fastened to an ordinary table-top. It simply consists of a double cutting-board, the lower one a few inches longer than usual if anything but very small work is to be done, and the other fastened on to it with a piece of wood between, as directed for the donkey. A piece of string fastened to the upper or spring board is conducted through a hole in the other, taking care that it clears the edge of the table to near the floor, where it ends in a loop for the worker's foot.

All that it is essential for the worker with the fretsaw to know, both in cutting and making up work, has now been told, and in taking leave of our readers who have followed the course of instructions, we wish them hearty success in their efforts to put them to practical use.

INDEX.

PAGE		PAGE	
Adjusting hinges	97	Cement, Shellac	102
Adjustment of saw-blade	50	For xylonite	103
Advanced exercises in sawing	60, 66	Cherry-wood	43
Amboyna	47	Chestnut	43
American designs	73	Chisels	17
Saw-blades	6	Cleaning up	136
Ammonia vapour	110	Coloured inlays	142
Angles and outlines,		Copying designs	78
Cutting	66	By photography	81
Ash	42	From zinc frets	80, 81
Automatic lubrication	80, 101	Cork blocks	20
Bead-router, or scratch	18	Description and use of	20
Beech	42	Corners, Cutting	66
Bevel sawing	118	Orange joints, Additional strength for	89
Waste in	120	Cutting corners	66
Birch	42	Long points	69
Bleaching	111	Metals	100
Blisters, Causes of	136	Points	67
Boards, How to flatten	40	Scrolls	70
Superficial measurement of	41	Veneers	121
Boring tools	11	Cutting out	84
Bow-saw, Cabinet-makers'	10	General hints on	86
Jewellers'	9	On machine	85
Home-made	33	Cutting-board	12
How to use a	34	For fretsawing	12
Boxes, Making up	91	Home-made	35
Boxwood	47	Cyanotype process for re-producing designs	81
Brackets, Making up	89	Darkening woods	105, 109
Brown stain	110	By fumigation	110
Canary-wood	43	Defective saw-blades	5
Cardboard backing	94	Design, Best method of cutting	70
Frets	81	Support for weak parts of	71
Rubbings from	81	Designs, American, Chief characteristics of	73
Cauls, The	135		
Hot	138		
Cedar	42		

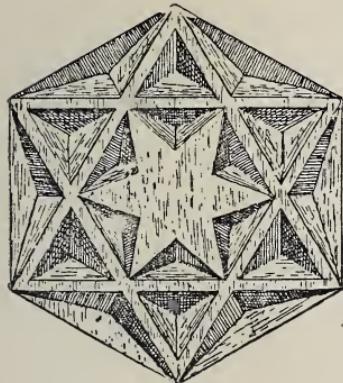
	PAGE		PAGE
Designs, Choice of wood for	75	Fretsaw-blades	6
Copying	78, 80, 81	Double-edged	6
English	73	Fretwork as a fine art	1
German	74	Fret-workers, Sizes of wood for	41
Italian	74	Fumigation	110
On wood, Getting	77, 124	Gauge	17
Plans and sections of	77	German designs	74
Preserving original	78	Getting designs on wood	77
Pricking outlines of	128	Remarks on	81
Transferring, to metal	101	Gilded backgrounds	95
Donkey, The	131	Gimlets and bradawls	18
Making a marquetry-		Glaze	107
cutters'	149	Applying	107
Setting the	151	Glass linings	95
Simple form of	150	Glass-paper	19
Substitute for	158	Use of	20
Doors, Construction of	99	Glue	18
Hanging	98	Preparation of	19
Double-edged fretsaw-blades	6	Selection of	18
Difficulty of working	7	Use of	19
Dowelled joints	90	Grains in wood	130
Dowels	90	Hammer	14
Drawings, Sectional	76	Hand-frame Sawing	51
Drill-stock	11	Cutting angles	57
Archimedean	11	Cutting curves	57
Continuous-cutting	12	First lesson in	54
Drill polishing	108	Turning in	57
Drills, Fine	116	With handle downwards	56
For marquetry	116	With handle upwards	55
How to use	12	Hand machines	22
Removing broken	116	Cheap form of	23
Duplicates of fret	80	Handle of home-made saw-	
Dyed veneers	127	frame	32
Ebony	43	Hanging doors without	
English designs	73	hinges	98
Files, Use of	13	Hingeing	96
Fillers	105	Hinges	95
Filling in	106	Ornamental plate	98
First lessons in hand-frame		Hints on cutting out	86
sawing	50	Holly	43
Lessons on cutting with		Home-made tools and appli-	
the machine	62	ances, Construction of	32
Fitting the saw-blades	51	Cutting-board	35
Foundations for veneer	133, 135	How to use	38
White	138	Preparing irons for	38
French polish	105	Saw-frames	31
Polishing	104	Scratch, or router	36

PAGE		PAGE	
Home-made tools and appliances : Shooting-board	36	Making up : Hingeing	97
Imitation of ivory	48	Hinges	95
Imperfect saw-blades	5	Keying	88
Inlaid veneers	134	Lining boxes	93
Inlaying	112	"Shooting" edges and mitres	88
Easy	123	Sides of boxes	88
Marquetry	127	Strengthening corners	89
Plain	115	Maple	43
Inlays	120	Marquetry	112
Coloured	142	Definition of	126
Cut separately	123	Drills for.	116
German and Italian designs for	141	Inlaying	127
Groundwork of	128	Making up	133
Making up	133	Materials for	127
Shading	143	Saws for	116
Italian designs	74	Materials for marquetry	127
Ivorine	48	Hardness of	117
Ivory	47	Ivory	47
Kerf, or saw-cut	41	Metal	47
Keyhole	98	Remarks on	39
Keying, Cutting the	88	Thickness of	117
Lacquer	102	Tortoise-shell	47
How used	102	Veneers	47
Laying on veneer	133	Vulcanite	48
Lime	43	Wood	42
Linings for fretwork boxes	91, 93, 95	Xylonite	48
Locks	98	Metals	47
Adjusting and fitting	99	Cutting and working	100
Lubricating the saw-blade	80, 101	Fret-sawing	6
Machine, Cutting with the	63	Lacquering	102
Movable arms and saw-clamps in	64	Mountings	102
Position of operator	65	Transferring design to	101
Putting in blade	63	Mitre block	17
Speed of	65	Use of	17
Testing-stroke	64	Mother-of-pearl	47
Treadling	65	Movable arms and saw-clamps	64
Machines for fret-cutters	22	Nails and needle-points	20
Mahogany	44	Necessary tools	4
Making up	87	Needle-points, Use of	20
Boxes	91	Oak	44
Brackets	89	Oiling	109
Dowel joints	90	Oilstone	18
Glued joints	89	Olive	44
		Original designs, Methods of preserving	78

	PAGE		PAGE
Original designs, taking copies of	78	Sawing, Exercises in Hand-frame	50, 61 50
Oxalic acid bleacher	111	Lessons in Machine	51, 54, 58 62
Panel ground	132	Marquetry	130
Pine	44	Width of cut in Scraper	51 13
Pitch	45	How to sharpen	13
Planes	15	Scratch, The	37
Points, Cutting	67	How to use the Irons for	38 37
Polishing	104, 106, 111	Preparing irons for	38
Before cutting	107	Screws	20
Edges	108	Sizes required	20
Xylonite	111	Screw-drivers	14
Pounce powders	129	Scrolls, Cutting	70
Pouncing	128	Sequoia, or Californian red pine	45
Purple wood	47	Shading by blackened lines	145
Quilted silk linings	94	Hot sand method of	143
Reproduction of designs by graph	81	Inlays	140, 143, 146
By photography	81	Shooting-board	16
Rosewood	45	Description and use of	16
Veneer	129	Speed	65
Router	37	Spiriting off	106
Satinwood	45	Square	17
Saw-blades, Adjustment of American	50	Staining	109
Fancy	6	Stencil, Pricking	128
For beginners	7	Stopping joints	127
For marquetry	130	Mixtures for	137
How to fix	51	Stringings	146
Imperfect	5	Making and laying	147
Numbers and sizes of 5, 7,	117	Stroke, the, Testing	64
Putting in machine	63	Sycamore	45
“Set” of	5	Tenon saws	11
Testing	5	Tension, Degree of, for saw-blade	51
Saw-clamps	31	Thuja	47
Saw-frames	8	Time between laying veneer and cleaning off	136
Hand, iron	8	Tools and appliances	4
Home-made	30	Home-made	30
Sizes of, how reckoned	9	Necessary	15
Types principally used	9	Tooothing plane	134
Wood	9	Tortoise-shell	47
Saw for heavy work	7	Transferring designs	78, 81, 101
“Set”	5	Treadle machines	23
Saw-gate, The	61		
Sawing, Bevel	118		
Cutting action in	51		
Difficulties in	131		

PAGE	PAGE		
Treadle machines, Cutting capacity of	30	Waste in cutting, How to avoid	83
Description of principal	24	Wax polish	108
Selecting	24	White foundations	138
The Dexter	25	Glue	138
The Lester	25	Wood, Getting design on	77
The Rival	25	Thickness of	41, 76
Treatment and care of	28	Three-ply	41
Tulip-wood	47	Veneers	41
Veneer, Laying, on curves	139	Woods for fret-cutters	42
Veneers	46	Choice of	75
Figured	130	For groundwork of inlays	128
Foundation for	133, 135	Grain of	84
Knife-cut	42	Working metals	100
Laying on	133	To design	66
List of	47	Xylonite	48
Preparing for cutting	121, 129	Cement for	138
Saw-cut	42	For marquetry	131
Saws for marquetry	130	For plain fret-cutting	49
Vertical cut, Importance of	62	Gauges of	49
Vulcanite	48	Stopping	158
Walnut	45	Veneers,	139
Waste in cutting	84	Yew	46
		Zinc frets	80

Wood=Carving = = = *for Amateurs.*



Full Instructions for producing
all the Different Varieties of
Carvings.

SECOND EDITION.

FULLY ILLUSTRATED.

In paper, price 1s., by post 1s. 2d.

Bent Iron Work.

A Practical Manual of Instruction for Amateurs in the Art and Craft of Making and Ornamenting Light Articles in imitation of the beautiful Mediæval and Italian Wrought Iron Work.

BY F. J. ERSKINE.

ILLUSTRATED.

In paper, price 1s., by post, 1s. 2d.



London : L. Upcott Gill, 170, Strand, W.C.

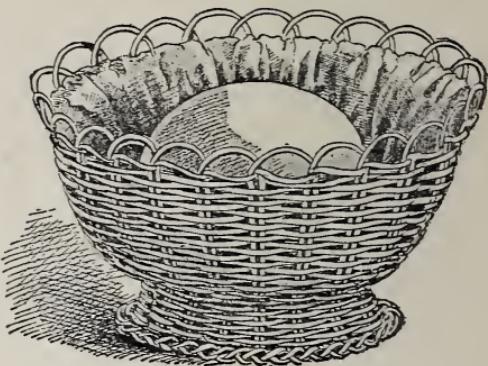
Cane Basket Work.

A Practical Manual
on Weaving Useful
and Fancy Baskets.

By ANNIE FIRTH.

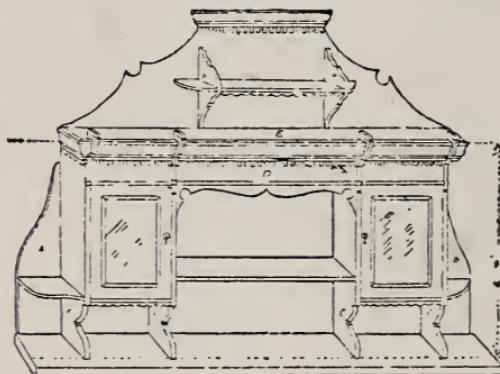
ILLUSTRATED.

*In cloth gilt, price 1s. 6d.,
by post 1s. 8d.*



Cabinet Making = = = for Amateurs.

Being clear Directions how to Construct many Useful
Articles, such as
Brackets, Side-
boards, Tables, Cup-
boards, and other
Furniture.



ILLUSTRATED.

*In cloth gilt, price
2s. 6d., by post 2s. 9d.*

London: L. Upcott Gill, 170, Strand, W.C.

Catalogue of Practical Handbooks
 Published by L. Upcott Gill,
 170, Strand, London, W.C.

CONTENTS.

ART.	PAGE	GARDENING.	PAGE	PAGE	
DESIGNING	5	BEGONIA CULTURE	2	BUTTERFLIES.....	3
OLD VIOLINS	12	BULB CULTURE	3	DIRECTORY.....	8
PAINTING.....	8	CACTUS CULTURE	3	DRAGONFLIES	3
PERSPECTIVE.....	8	CARNATION CULTURE ..	4	HAWK MOTHS	7
VIOLIN SCHOOL.....	12	CHRYSANTHEMUM CUL- TURE	4	SKETCHES	8
AMUSEMENTS.		CUCUMBER CULTURE	4	SNAKES.....	11
AMATEUR ENTERTAIN- MENTS	5	DICTIONARY	6	TAXIDERMY	11
BUNKUM ENTERTAIN- MENTS	3	FERNS	5	VIVARIUM	12
CARD CONJURING	4	FRUIT CULTURE	6	PETS.	
CARD TRICKS	4	GARDENING IN EGYPT ..	6	BRITISH BIRDS	2
CONJURING	4, 11	GRAPE GROWING	7	CAGE BIRDS' DISEASES ..	3
GAMES	6	GREENHOUSE MANAGE- MENT	7	CANARIES	3
MAGIC LANTERNS	7	HARDY PERENNIALS ..	7	CATS	4
PATIENCE	8	HOME	6	CRIES AND CALL NOTES ..	12
POOL	9	MUSHROOM CULTURE ..	8	FEATHERED FRIENDS ..	5
SHADOW ENTERTAIN- MENTS	11	ORCHIDS	8	FOREIGN BIRDS	6
SLEIGHT OF HAND	11	ROSES	10	GREY PARROTS	8
SOLO WHIST	11	TOMATO CULTURE	12	GUINEA PIG	7
VAMPING	12	TOMATO GROWING	12	MICE	7
VENTRiloQUISM	12	VEGETABLE CULTURE ..	12	MONKEYS	8
WHIST	12	HOME.		NOTES ON CAGE BIRDS ..	3
COLLECTORS.		AMERICAN DAINTIES ..	2	PARRAKEETS	8
AUTOGRAPH	2	COLD MEAT COOKERY ..	4	PHEASANTS	9
BOOKS	7	COOKERY	4	RABBITS	10
COINS	4	EGG COOKERY	5	SPEAKING PARROTS ..	8
ENGRAVINGS	5	ENGLISH AND FOREIGN DAINTIES	5	POULTRY & PIGEONS.	
HANDWRITING	7	FANCY WORK	5	DISEASES	9
LIBRARY MANUAL	7	FISH, FLESH, & FOWL ..	6	FANCY PIGEONS	9
PAINTERS	8	HOME MEDICINE	8	INCUBATORS	7
POSTAGE STAMPS	9	MILLINERY	7	LAYING HENS	7
POSTMARKS	9	NEEDLEWORK DIC- TIONARY	8	PIGEON-KEEPING	9
POTTERY & PORCELAIN	9	SHAVING	11	POULTRY-FARMING ..	9
SPORTING BOOKS	11	MECHANICS.		POULTRY-KEEPING	9
STAMPS OF EUROPE	9	BENT IRONWORK	2	SPORT	
WAR MEDALS	12	BOAT BUILDING	2	ANGLING	2, 6
DOGS & HORSES.		BOOKBINDING	3	BOAT SAILING	3
BREAKING DOGS	5	CABINET MAKING	3	CYLING MAP	5, 10
BREEDERS' RECORDS ..	3	CANE BASKET WORK ..	4	FERRETS	6
BRITISH DOGS	5	FIREWORK MAKING ..	6	GAME PRESERVING ..	6
COLLIE	4	FRETWORK	6	SEA-FISHING	2, 10
DISEASES OF DOGS ..	5	MARQUETERIE	6	SKATING	11
DISEASES OF HORSES ..	7	MODEL YACHTS	8	TRAPPING	12
DOG-KEEPING	5	PIANO TUNING	9	WILDFOWLING	12
FOX TERRIER	6	PICTURE-FRAME MAK- ING	9	WILD SPORTS	12
GREYHOUND	7	SHEET METAL WORK ..	11	TOURIST.	
HORSE-KEEPER	7	TICKET WRITING ..	13	DICTIONARY OF SEA TERMS	11
HORSE-KEEPING	7	TURNING LATHES ..	12	FRIESLAND MERES	6
ST. BERNARD	10	WIRE GAUGES	13	INLAND WATERING PLACES	7
WHIPPET	12	WOOD CARVING	13	MOUNTAINEERING	8
FARM.		WOOD POLISHES	9	ROAD CHART	10
GOAT-KEEPING	6	WORKSHOP MAKE- SHIFTS	13	ROUTE MAP	5
PIG-KEEPING	9	NATURAL HISTORY.		SAILING TOURS	10
POULTRY FARMING ..	9	AQUARIA	2	SEA LIFE	11
SHEEP RAISING	11	BEES	2	SEASIDE WATERING PLACES	11
STOCK RECORDS	3			SOLENT GUIDE	10
				THAMES GUIDE	12

American Dainties, and How to Prepare Them. By an AMERICAN LADY.
In paper, price 1s. 2d.

Angler, Book of the All-Round. A Comprehensive Treatise on Angling in both Fresh and Salt Water. In Four Divisions as named below. By JOHN BICKERDYKE. With over 220 Engravings. *In cloth gilt, price 5s. 6d., by post 5s. 10d.*

Angling for Coarse Fish. Bottom Fishing, according to the Methods in use on the Thames, Trent, Norfolk Broads, and elsewhere. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Angling for Pike. The most approved Methods of Fishing for Pike or Jack. New Edition, revised and enlarged. Profusely Illustrated. *In paper, price 1s., by post 1s. 2d.; cloth, 2s. (uncut), by post 2s. 3d.*

Angling for Game Fish. The Various Methods of Fishing for Salmon; Moorland, Chalk-stream, and Thames Trout; Grayling and Char. Well Illustrated. *In paper, price 1s. 6d., by post 1s. 9d.*

Angling in Salt Water. Sea Fishing with Rod and Line, from the Shore, Piers, Jetties, Rocks, and from Boats; together with Some Account of Hand-Lining. Over 50 Engravings. *In paper, price 1s., by post, 1s. 2d.; cloth, 2s. (uncut), by post 2s. 3d.*

The Modern. A Practical Handbook on all Kinds of Angling. By "OTTER." Well illustrated. New Edition. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Aquaria, Book of. A Practical Guide to the Construction, Arrangement, and Management of Freshwater and Marine Aquaria; containing Full Information as to the Plants, Weeds, Fish, Molluscs, Insects, &c., How and Where to Obtain Them, and How to Keep Them in Health. By REV. GREGORY C. BATEMAN, A.K.C., and REGINALD A. R. BENNETT, B.A. Illustrated. *In cloth gilt, price 5s. 6d., by post 5s. 10d.*

Aquaria, Freshwater: Their Construction, Arrangement, Stocking, and Management. By REV. G. C. BATEMAN, A.K.C. Fully Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Aquaria, Marine: Their Construction, Arrangement, and Management. By R. A. R. BENNETT, B.A. Fully Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Autograph Collecting: A Practical Manual for Amateurs and Historical Students, containing ample information on the Selection and Arrangement of Autographs, the Detection of Forged Specimens, &c., &c., to which are added numerous Facsimiles for Study and Reference, and an extensive Valuation Table of Autographs worth Collecting. By HENRY T. SCOTT, M.D., L.R.C.P., &c. *In leatherette gilt, price 7s. 6d. nett, by post 7s. 10d.*

Bazaars and Fancy Fairs: Their Organization and Management. A Secretary's *Vade Mecum*. By JOHN MUIR. *In paper, price 1s., by post 1s. 2d.*

Bees and Bee-Keeping: Scientific and Practical. By F. R. CHESHIRE, F.L.S., F.R.M.S., Lecturer on Apiculture at South Kensington. *In two vols., cloth gilt, price 16s., by post 16s. 6d.*

Vol. I., Scientific. A complete Treatise on the Anatomy and Physiology of the Hive Bee. *In cloth gilt, price 7s. 6d., by post 7s. 10d.*

Vol. II., Practical Management of Bees. An Exhaustive Treatise on Advanced Bee Culture. *In cloth gilt, price 8s. 6d., by post 8s. 11d.*

Bee-Keeping, Book of. A very practical and Complete Manual on the Proper Management of Bees, especially written for Beginners and Amateurs who have but a few Hives. By W. B. WEBSTER, First-class Expert, B.B.K.A. Fully Illustrated. *In paper, price 1s., by post 1s. 2d.; cloth, 1s. 6d., by post 1s. 8d.*

Begonia Culture, for Amateurs and Professionals. Containing Full Directions for the Successful Cultivation of the Begonia, under Glass and in the Open Air. By B. C. RAVENSCROFT. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Bent Iron Work: A Practical Manual of Instruction for Amateurs in the Art and Craft of Making and Ornamenting Light Articles in imitation of the beautiful Mediæval and Italian Wrought Iron Work. By F. J. ERSKINE. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Birds, British, for the Cage and Aviary. Illustrated. By DR. W. T. GREENE. *[In the press.]*

Boat Building and Sailing, Practical. Containing Full Instructions for Designing and Building Punts, Skiffs, Canoes, Sailing Boats, &c. Particulars of the most suitable Sailing Boats and Yachts for Amateurs, and Instructions for their Proper Handling. Fully Illustrated with Designs and Working Diagrams. By ADRIAN NEISON, C.E., DIXON KEMP, A.I.N.A., and G. CHRISTOPHER DAVIES. *In one vol., cloth gilt, price 7s. 6d., by post 7s. 10d.*

Boat Building for Amateurs, Practical. Containing Full Instructions for Designing and Building Punts, Skiffs, Canoes, Sailing Boats, &c. Fully Illustrated with Working Diagrams. By ADRIAN NEISON, C.E. Second Edition, Revised and Enlarged by DIXON KEMP, Author of "A Manual of Yacht and Boat Sailing," &c. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Boat Sailing for Amateurs, Practical. Containing Particulars of the most Suitable Sailing Boats and Yachts for Amateurs, and Instructions for their Proper Handling, &c. Illustrated with numerous Diagrams. By G. CHRISTOPHER DAVIES. Second Edition, Revised and Enlarged, and with several New Plans of Yachts. *In cloth gilt, price 5s., by post 5s. 4d.*

Bookbinding for Amateurs: Being Descriptions of the various Tools and Appliances Required, and Minute Instructions for their Effective Use. By W. J. E. CRANE. Illustrated with 156 Engravings. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Breeders' and Exhibitors' Record, for the Registration of Particulars concerning Pedigree Stock of every Description. By W. K. TAUNTON. In 3 Parts. Part I., The Pedigree Record. Part II., The Stud Record. Part III., The Show Record. *In cloth gilt, price each Part 2s. 6d., or the set 6s., by post 6s. 6d.*

British Dragonflies. Being an Exhaustive Treatise on our Native Odonata : Their Collection, Classification, and Preservation. By W. J. LUCAS, B.A. Very fully Illustrated, with about 40 Coloured Plates, and numerous Black-and-White Engravings. *In cloth gilt, by subscription, 2ls. nett. The price will be raised on publication to not less than 30s.*

Bulb Culture, Popular. A Practical and Handy Guide to the Successful Cultivation of Bulbous Plants, both in the Open and under Glass. By W. D. DRURY. Fully Illustrated. *In paper, price 1s., by post 1s. 2d.*

Bunkum Entertainments: A Collection of Original Laughable Skits on Conjuring, Physiognomy, Juggling, Performing Fleas, Waxworks, Panorama, Phrenology, Phonograph, Second Sight, Lightning Calculators, Ventriloquism, Spiritualism, &c., to which are added Humorous Sketches, Whimsical Recitals, and Drawing-room Comedies. By ROBERT GANTHONY Illustrated. *In cloth, price 2s. 6d., by post 2s. 9d.*

Butterflies, The Book of British: A Practical Manual for Collectors and Naturalists. Splendidly Illustrated throughout with very accurate Engravings of the Caterpillars, Chrysalids, and Butterflies, both upper and under sides, from drawings by the Author or direct from Nature. By W. J. LUCAS, B.A. *In cloth gilt, price 5s. 6d., by post 5s. 9d.*

Butterfly and Moth Collecting: Where to Search, and What to Do. By G. E. SIMMS. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Cabinet Making for Amateurs. Being clear Directions How to Construct many Useful Articles, such as Brackets, Sideboard, Tables, Cupboards, and other Furniture. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Cactus Culture for Amateurs: Being Descriptions of the various Cactuses grown in this country; with Full and Practical Instructions for their Successful Cultivation. By W. WATSON, Assistant Curator of the Royal Botanic Gardens, Kew. Profusely Illustrated. *In cloth, gilt, price 5s. nett, by post 5s. 4d.*

Cage Birds, Diseases of: Their Causes, Symptoms, and Treatment. A Handbook for everyone who keeps a Bird. By DR. W. T. GREENE, F.Z.S. *In paper, price 1s., by post 1s. 2d.*

Cage Birds, Notes on. Second Series. Being Practical Hints on the Management of British and Foreign Cage Birds, Hybrids, and Canaries. By various Fanciers. Edited by DR. W. T. GREENE. *In cloth gilt, price 6s., by post 6s. 6d.*

Canary Book. The Breeding, Rearing, and Management of all Varieties of Canaries and Canary Mules, and all other matters connected with this Fancy. By ROBERT L. WALLACE. Third Edition. *In cloth gilt, price 5s., by post 5s. 4d.; with COLOURED PLATES, 6s. 6d., by post 6s. 10d.*

General Management of Canaries. Cages and Cage-making, Breeding, Managing, Mule Breeding, Diseases and their Treatment, Moulting, Pests, &c. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Exhibition Canaries. Full Particulars of all the different Varieties, their Points of Excellence, Preparing Birds for Exhibition, Formation and Management of Canary Societies and Exhibitions. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Cane Basket Work: A Practical Manual on Weaving Useful and Fancy Baskets By ANNIE FIRTH. Illustrated. *In cloth gilt, price 1s. 6d., by post 1s. 8d.*

Card Conjuring: Being Tricks with Cards, and How to Perform Them. By PROF. ELLIS STANYON. Illustrated, and in Coloured Wrapper. *Price 1s., by post 1s. 2d.*

Card Tricks, Book of, for Drawing-room and Stage Entertainments by Amateurs; with an exposure of Tricks as practised by Card Sharpers and Swindlers. Numerous Illustrations. By PROF. R. KUNARD. *In illustrated wrapper, price 2s. 6d., by post 2s. 9d.*

Carnation Culture, for Amateurs. The Culture of Carnations and Picotees of all Classes in the Open Ground and in Pots. By B. C. RAVENSCROFT. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Cats, Domestic or Fancy: A Practical Treatise on their Antiquity, Domestication, Varieties, Breeding, Management, Diseases and Remedies, Exhibition and Judging. By JOHN JENNINGS. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Chrysanthemum Culture, for Amateurs and Professionals. Containing Full Directions for the Successful Cultivation of the Chrysanthemum for Exhibition and the Market. By B. C. RAVENSCROFT. New Edition. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Chrysanthemum, The Show, and Its Cultivation. By C. SCOTT, of the Sheffield Chrysanthemum Society. *In paper, price 6d., by post 7d.*

Coins, a Guide to English Pattern, in Gold, Silver, Copper, and Pewter, from Edward I. to Victoria, with their Value. By the REV. G. F. CROWTHER, M.A. Illustrated. *In silver cloth, with gilt facsimiles of Coins, price 5s., by post 5s. 3d.*

Coins of Great Britain and Ireland, a Guide to the, in Gold, Silver, and Copper, from the Earliest Period to the Present Time, with their Value. By the late COLONEL W. STEWART THORBURN. Third Edition. Revised and Enlarged, by H. A. GRUEBER, F.S.A. Illustrated. *In cloth gilt, price 10s. 6d. net, by post 10s. 10d.*

Cold Meat Cookery. A Handy Guide to making really tasty and much appreciated Dishes from Cold Meat. By MRS. J. E. DAVIDSON. *In paper, price 1s., by post 1s. 2d.*

Collie, The. Its History, Points, and Breeding. By HUGH DALZIEL, Illustrated with Coloured Frontispiece and Plates. *In paper, price 1s., by post 1s. 2d.; cloth gilt, 2s., by post 2s. 3d.*

Collie Stud Book. Edited by HUGH DALZIEL. *In cloth gilt, price 3s. 6d. each, by post 3s. 9d. each.*

Vol. I., containing Pedigrees of 1308 of the best-known Dogs, traced to their most remote known ancestors; Show Record to Feb., 1890, &c.

Vol. II. Pedigrees of 795 Dogs, Show Record, &c.

Vol. III. Pedigrees of 786 Dogs, Show Record, &c.

Conjuring, Book of Modern. A Practical Guide to Drawing-room and Stage Magic for Amateurs. By PROFESSOR R. KUNARD. Illustrated. *In illustrated wrapper, price 2s. 6d., by post 2s. 9d.*

Conjuring for Amateurs. A Practical Handbook on How to Perform a Number of Amusing Tricks. By PROF. ELLIS STANYON. *In paper, price 1s., by post 1s. 2d.*

Cookery, The Encyclopædia of Practical. A complete Dictionary of all pertaining to the Art of Cookery and Table Service. Edited by THEO. FRANCIS GARRETT, assisted by eminent Chefs de Cuisine and Confectioners. Profusely Illustrated with Coloured Plates and Engravings by HAROLD FURNESS, GEO. CRUIKSHANK, W. MUNN ANDREW, and others. *In 2 vols., demy 4to., half morocco, cushion edges, price £3 3s.; carriage free, £3 5s.*

Cookery for Amateurs; or, French Dishes for English Homes of all Classes. Includes Simple Cookery, Middle-class Cookery, Superior Cookery, Cookery for Invalids, and Breakfast and Luncheon Cookery. By MADAME VALÉRIE. Second Edition. *In paper, price 1s., by post 1s. 2d.*

Cucumber Culture for Amateurs. Including also Melons, Vegetable Marrows, and Gourds. Illustrated. By W. J. MAY. *In paper, price 1s., by post 1s. 2d.*

Cyclist's Route Map of England and Wales. Shows clearly all the Main, and most of the Cross, Roads, Railroads, and the Distances between the Chief Towns, as well as the Mileage from London. In addition to this, Routes of *Thirty of the Most Interesting Tours* are printed in red. Fourth Edition, thoroughly revised. The map is printed on specially prepared vellum paper, and is the fullest, handiest, and best up-to-date tourist's map in the market. *In cloth, price 1s., by post 1s. 2d.*

Dainties, English and Foreign, and How to Prepare Them. By MRS. DAVIDSON. *In paper, price 1s., by post 1s. 2d.*

Designing, Harmonic and Keyboard. Explaining a System whereby an endless Variety of Most Beautiful Designs suited to numberless Manufactures may be obtained by Unskilled Persons from any Printed Music. Illustrated by Numerous Explanatory Diagrams and Illustrative Examples. By C. H. WILKINSON. *Demy 4to, cloth gilt, price £3 3s. nett, by post £3 3s. 8d.*

Dogs, Breaking and Training: Being Concise Directions for the proper education of Dogs, both for the Field and for Companions. Second Edition. By "PATHFINDER." With Chapters by HUGH DALZIEL. Illustrated. *In cloth gilt, price 6s. 6d., by post 6s. 10d.*

Dogs, British, Ancient and Modern: Their Varieties, History, and Characteristics. By HUGH DALZIEL, assisted by Eminent Fanciers. Beautifully Illustrated with COLOURED PLATES and full-page Engravings of Dogs of the Day, with numerous smaller illustrations in the text. This is the fullest work on the various breeds of dogs kept in England. In three volumes, *demy 8vo, cloth gilt, price 10s. 6d. each, by post 11s. each.*

Vol. I. Dogs Used in Field Sports.

Vol. II. Dogs Useful to Man in other Work than Field Sports; House and Toy Dogs.

Vol. III. Practical Kennel Management: A Complete Treatise on all Matters relating to the Proper Management of Dogs whether kept for the Show Bench, for the Field, or for Companions.

Dogs, Diseases of: Their Causes, Symptoms, and Treatment; Modes of Administering Medicines; Treatment in cases of Poisoning, &c. For the use of Amateurs. By HUGH DALZIEL. Fourth Edition. Entirely Re-written and brought up to Date. *In paper, price 1s., by post 1s. 2d.; in cloth gilt, 2s., by post 2s. 3d.*

Dog-Keeping, Popular: Being a Handy Guide to the General Management and Training of all Kinds of Dogs for Companions and Pets. By J. MAXTEE. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Egg Cookery. How to Cook Eggs, One Hundred and Fifty Different Ways, English and Foreign. *In paper, price 1s., by post 1s. 2d.*

Engravings and their Value. Containing a Dictionary of all the Greatest Engravers and their Works. By J. H. SLATER. New Edition, Revised and brought up to date, with latest Prices at Auction. *In cloth gilt, price 15s. nett, by post, 15s. 5d.*

Entertainments, Amateur, for Charitable and other Objects: How to Organise and Work them with Profit and Success. By ROBERT GANTHONY. *In paper, price 1s., by post 1s. 2d.*

Fancy Work Series, Artistic. A Series of Illustrated Manuals on Artistic and Popular Fancy Work of various kinds. Each number is complete in itself, and issued at the uniform price of 6d., by post 7d. Now ready—(1) MACRAMÉ LACE (Second Edition); (2) PATCHWORK; (3) TATTING; (4) CREWEL WORK; (5) APPLIQUÉ; (6) FANCY NETTING.

Feathered Friends, Old and New. Being the Experience of many years' Observation of the Habits of British and Foreign Cage Birds. By DR. W. T. GREENE. Illustrated. *In cloth gilt, price 5s., by post 5s. 4d.*

Ferns, The Book of Choice: for the Garden, Conservatory, and Stove. Describing the best and most striking Ferns and Selaginellas, and giving explicit directions for their Cultivation, the formation of Rockeries, the arrangement of Ferneries, &c. By GEORGE SCHNEIDER. With numerous Coloured Plates and other Illustrations. *In 3 vols., large post 4to. Cloth gilt, price £3 3s. nett, by post £3 5s.*

Ferns, Choice British. Descriptive of the most beautiful Variations from the common forms, and their Culture. By C. T. DRUERY, F.L.S. Very accurate PLATES, and other Illustrations. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Ferrets and Ferreting. Containing Instructions for the Breeding, Management, and Working of Ferrets. Second Edition, Re-written and greatly Enlarged. Illustrated. *In paper, price 6d., by post 7d.*

Fertility of Eggs Certificate. These are Forms of Guarantee given by the Sellers to the Buyers of Eggs for Hatching, undertaking to refund value of any unfertile eggs, or to replace them with good ones. Very valuable to sellers of eggs, as they induce purchases. *In books, with counterfoils. price 6d., by post 7d.*

Firework Making for Amateurs. A complete, accurate, and easily-understood work on Making Simple and High-class Fireworks. By DR. W. H. BROWNE, M.A. *In coloured wrapper, price 2s 6d., by post 2s. 9d.*

Fisherman, The Practical. Dealing with the Natural History, the Legendary Lore, the Capture of British Fresh-Water Fish, and Tackle and Tackle-making. By J. H. KEENE. *In cloth gilt, price 7s. 6d., by post 7s. 10d.*

Fish, Flesh, and Fowl. When in Season, How to Select, Cook, and Serve. By MARY BARRETT BROWN. *In paper, price 1s., by post 1s. 3d.*

Foreign Birds, Favourite for Cages and Aviaries. How to Keep them in Health. By W. T. GREENE, M.A., M.D., F.Z.S., &c. Fully Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Fox Terrier, The. Its History, Points, Breeding, Rearing, Preparing for Exhibition, and Coursing. By HUGH DALZIEL. Illustrated with Coloured Frontispiece and Plates. *In paper, price 1s., by post 1s. 2d.; cloth, 2s., by post 2s. 3d.*

Fox Terrier Stud Book. Edited by HUGH DALZIEL. *In cloth gilt, price 3s. 6d. each, by post 3s. 9d. each.*

Vol. I. containing Pedigrees of over 1400 of the best-known Dogs, traced to their most remote known ancestors.

Vol. II. Pedigrees of 1544 Dogs, Show Record, &c.

Vol. III. Pedigrees of 1214 Dogs, Show Record, &c.

Vol. IV. Pedigrees of 1168 Dogs, Show Record, &c.

Vol. V. Pedigrees of 1662 Dogs, Show Record, &c.

Fretwork and Marquetry. A Practical Manual of Instructions in the Art of Fret-cutting and Marquetry Work. By D. DENNING. Profusely Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Friesland Meres, A Cruise on the. By ERNEST R. SUFFLING. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Fruit Culture for Amateurs. By S. T. WRIGHT. With Chapters on Insect and other Fruit Pests by W. D. DRURY. Second Edition. Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 9d.*

Game Preserving, Practical. Containing the fullest Directions for Rearing and Preserving both Winged and Ground Game, and Destroying Vermin; with other Information of Value to the Game Preserver. By W. CARNEGIE. Illustrated. *In cloth gilt, demy 8vo, price 2ls. by post 2ls. 5d.*

Games, the Book of a Hundred. By MARY WHITE. These Games are for Adults, and will be found extremely serviceable for Parlour Entertainment. They are Clearly Explained, are Ingenious, Clever, Amusing, and exceedingly Novel. *In stiff boards, price 2s. 6d. by post 2s. 9d.*

Gardening, Dictionary of. A Practical Encyclopaedia of Horticulture, for Amateurs and Professionals. Illustrated with 2440 Engravings. Edited by G. NICHOLSON, Curator of the Royal Botanic Gardens, Kew; assisted by Prof. Trail, M.D., Rev. P. W. Myles, B.A., F.L.S., W. Watson, J. Garrett, and other Specialists. *In 4 vols., large post 4to. Cloth gilt, price £3, by post £3 2s.*

Gardening in Egypt. A Handbook of Gardening for Lower Egypt. With a Calendar of Work for the different Months of the Year. By WALTER DRAPER. *In cloth gilt, price 3s. 6d., by post 3s. 9d.*

Gardening, Home. A Manual for the Amateur, Containing Instructions for the Laying Out, Stocking, Cultivation, and Management of Small Gardens—Flower, Fruit, and Vegetable. By W. D. DRURY, F.R.H.S. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Goat, Book of the. Containing Full Particulars of the Various Breeds of Goats, and their Profitable Management. With many Plates. By H. STEPHEN HOLMES PEGLER. Third Edition, with Engravings and Coloured Frontispiece. *In cloth gilt, price 4s. 6d., by post 4s. 10d.*

Goat-Keeping for Amateurs: Being the Practical Management of Goats for Milking Purposes. Abridged from "The Book of the Goat." Illustrated. *In paper, price 1s., by post 1s. 2d.*

Grape Growing for Amateurs. A Thoroughly Practical Book on Successful Vine Culture. By E. MOLYNEUX. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Greenhouse Management for Amateurs. The Best Greenhouses and Frames, and How to Build and Heat them, Illustrated Descriptions of the most suitable Plants, with general and Special Cultural Directions, and all necessary information for the Guidance of the Amateur. By W. J. MAY. Second Edition, Revised and Enlarged. Magnificently Illustrated. *In cloth gilt, price 5s., by post 5s. 4d.*

Greyhound, The: Its History, Points, Breeding, Rearing, Training, and Running. By HUGH DALZIEL. With Coloured Frontispiece. *In cloth gilt, demy 8vo., price 2s. 6d., by post 2s. 9d.*

Guinea Pig, The: for Food, Fur, and Fancy. Its Varieties and its Management. By C. CUMBERLAND, F.Z.S. Illustrated. *In paper, price 1s., by post 1s. 2d. In cloth gilt, with coloured frontispiece, price 2s. 6d., by post 2s. 9d.*

Handwriting, Character Indicated by. With Illustrations in Support of the Theories advanced, taken from Autograph Letters, of Statesmen, Lawyers, Soldiers, Ecclesiastics, Authors, Poets, Musicians, Actors, and other persons. Second Edition. By R. BAUGHAN. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Hardy Perennials and Old-fashioned Garden Flowers. Descriptions, alphabetically arranged, of the most desirable Plants for Borders, Rockeries, and Shrubberies, including Foliage as well as Flowering Plants. By J. WOOD. Profusely Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 9d.*

Hawk Moths, Book of British. A Popular and Practical Manual for all Lepidopterists. Copiously illustrated in black and white from the Author's own exquisite Drawings from Nature. By W. J. LUCAS, B.A. *In cloth gilt, price 3s. 6d., by post 3s. 9d.*

Home Medicine and Surgery: A Dictionary of Diseases and Accidents, and their proper Home Treatment. For Family Use. By W. J. MACKENZIE, M.D. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Horse-Keeper, The Practical. By GEORGE FLEMING, C.B., LL.D., F.R.C.V.S., late Principal Veterinary Surgeon to the British Army, and Ex-President of the Royal College of Veterinary Surgeons. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Horse-Keeping for Amateurs. A Practical Manual on the Management of Horses, for the guidance of those who keep one or two for their personal use. By FOX RUSSELL. *In paper, price 1s., by post 1s. 2d.; cloth gilt 2s., by post 2s. 3d.*

Horses, Diseases of: Their Causes, Symptoms, and Treatment. For the use of Amateurs. By HUGH DALZIEL. *In paper, price 1s., by post 1s. 2d.; cloth gilt 2s., by post 2s. 3d.*

Incubators and their Management. By J. H. SUTCLIFFE. New Edition, Revised and Enlarged. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Inland Watering Places. A Description of the Spas of Great Britain and Ireland, their Mineral Waters, and their Medicinal Value, and the attractions which they offer to Invalids and other Visitors. Profusely illustrated. A Companion Volume to "Seaside Watering Places." *In cloth gilt, price 2s. 6d., by post 2s. 10d.*

Jack All Alone. Being a Collection of Descriptive Yachting Reminiscences. By FRANK COWPER, B.A., Author of "Sailing Tours." Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Journalism, Practical: How to Enter Thereon and Succeed. A book for all who think of "writing for the Press." By JOHN DAWSON. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Laying Hens, How to Keep and to Rear Chickens in Large or Small Numbers, in Absolute Confinement, with Perfect Success. By MAJOR G. F. MORANT. *In paper, price 6d., by post 7d.*

Library Manual, The. A Guide to the Formation of a Library, and the Values of Rare and Standard Books. By J. H. SLATER, Barrister-at-Law. Third Edition. Revised and Greatly Enlarged. *In cloth gilt, price 7s. 6d. nett, by post 7s. 10d.*

Magic Lanterns, Modern. A Guide to the Management of the Optical Lantern, for the Use of Entertainers, Lecturers, Photographers, Teachers, and others. By R. CHILD BAYLEY. *In paper, price 1s., by post 1s. 2d.*

Mice, Fancy: Their Varieties, Management, and Breeding. Third Edition, with additional matter and Illustrations. *In coloured wrapper representing different varieties, price 1s., by post 1s. 2d.*

Millinery, Handbook of. A Practical Manual of Instruction for Ladies. Illustrated. By MME. ROSÉE, Court Milliner, Principal of the School of Millinery. *In paper, price 1s., by post 1s. 2d.*

Model Yachts and Boats: Their Designing, Making, and Sailing. Illustrated with 118 Designs and Working Diagrams. By J. DU V. GROSVENOR. *In leatherette, price 5s., by post 5s. 3d.*

Monkeys, Pet, and How to Manage Them. Illustrated. By ARTHUR PATTERSON. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Mountaineering, Welsh. A Complete and Handy Guide to all the Best Roads and Bye-Paths by which the Tourist should Ascend the Welsh Mountains. By A. W. PERRY. With numerous Maps. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Mushroom Culture for Amateurs. With Full Directions for Successful Growth in Houses, Sheds, Cellars, and Pots, on Shelves, and Out of Doors. By W. J. MAY. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Natural History Sketches among the Carnivora—Wild and Domesticated; with Observations on their Habits and Mental Faculties. By ARTHUR NICOLS, F.G.S., F.R.G.S. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Naturalist's Directory, The, for 1899 (Fifth year of issue). Invaluable to all Students and Collectors. *In paper, price 1s., by post 1s. 1d.*

Needlework, Dictionary of. An Encyclopædia of Artistic, Plain, and Fancy Needlework; Plain, practical, complete, and magnificently Illustrated. By S. F. A. CAULFIELD and B. C. SAWARD. *In demy 4to, 528pp, 829 Illustrations, extra cloth gilt, plain edges, cushioned bevelled boards, price 21s. nett, by post 21s. 9d.; with COLOURED PLATES, elegant satin brocade cloth binding, and coloured edges, 31s. 6d. nett, by post 32s.*

Orchids: Their Culture and Management, with Descriptions of all the Kinds in General Cultivation. Illustrated by Coloured Plates and Engravings. By W. WATSON, Assistant-Curator, Royal Botanic Gardens, Kew; Assisted by W. BEAN, Foreman, Royal Gardens, Kew. Second Edition, Revised and with Extra Plates. *In cloth gilt and gilt edges, price £1 1s. nett, by post £1 1s. 6d.*

Painters and Their Works. A Work of the Greatest Value to Collectors and such as are interested in the Art, as it gives, besides Biographical Sketches of all the Artists of Repute (not now living) from the 13th Century to the present date, the Market Value of the Principal Works Painted by Them, with Full Descriptions of Same. *In 3 vols., cloth gilt, price 15s. net per vol., by post 15s. 5d., or 37s. 6d. net the set of 3, by post 38s. 3d.*

Painting, Decorative. A practical Handbook on Painting and Etching upon Textiles, Pottery, Porcelain, Paper, Vellum, Leather, Glass, Wood, Stone, Metals, and Plaster, for the Decoration of our Homes. By B. C. SAWARD. *In cloth gilt, price 3s. 6d., by post 3s. 9d.*

Parcel Post Dispatch Book (registered). An invaluable book for all who send parcels by post. Provides Address Labels, Certificate of Posting, and Record of Parcels Dispatched. By the use of this book parcels are insured against loss or damage to the extent of £2. Authorised by the Post Office. Price 1s., by post 1s. 2d., for 100 parcels; larger sizes if required.

Parrakeets, Popular. How to Keep and Breed Them. By DR. W. T. GREENE, M.D., M.A., F.Z.S., &c. *In paper, price 1s., by post, 1s. 2d.*

Parrot, The Grey, and How to Treat it. By W. T. GREENE, M.D., M.A., F.Z.S., &c. *In paper, price 1s., by post 1s. 2d.*

Parrots, the Speaking. The Art of Keeping and Breeding the principal Talking Parrots in Confinement. By DR. KARL RUSS. Illustrated with COLOURED PLATES and Engravings. *In cloth gilt, price 5s., by post 5s. 4d.*

Patience, Games of, for one or more Players. How to Play 142 different Games of Patience. By M. WHITMORE JONES. Illustrated. Series I., 39 games; Series II., 34 games; Series III., 33 games; Series IV., 37 games. *Each, in paper, 1s., by post 1s. 2d. The four bound together in cloth gilt, price 5s., by post 5s. 4d.*

Pedigree Record, The. Being Part I. of "The Breeders and Exhibitors Record," for the Registration of Particulars concerning Pedigrees of Stock of every Description. By W. K. TAUNTON. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Perspective, The Essentials of. With numerous Illustrations drawn by the Author. By L. W. MILLER, Principal of the School of Industrial Art of the Pennsylvania Museum, Philadelphia. Price 6s. 6d., by post 6s. 10d.

Pheasant-Keeping for Amateurs. A Practical Handbook on the Breeding, Rearing, and General Management of Fancy Pheasants in Confinement. By GEO. HORNE. Fully Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 9d.*

Photographic Printing Processes, Popular. A Practical Guide to Printing with Gelatino-Chloride, Artigue, Platinotype, Carbon, Bromide, Collodio-Chloride, Bichromated Gum, and other Sensitised Papers. By H. MACLEAN, F.R.P.S. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 10d.*

Photography (Modern) for Amateurs. New and Revised Edition. By J. EATON FEARN. *In paper, price 1s., by post 1s. 2d.*

Pianofortes, Tuning and Repairing. The Amateur's Guide to the Practical Management of a Piano without the intervention of a Professional. By CHARLES BABBINGTON. *In paper, price 6d., by post 6½d.*

Picture-Frame Making for Amateurs. Being Practical Instructions in the Making of various kinds of Frames for Paintings, Drawings, Photographs, and Engravings. By the REV. J. LUKIN. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Pig, Book of the. The Selection, Breeding, Feeding, and Management of the Pig; the Treatment of its Diseases; the Curing and Preserving of Hams, Bacon, and other Pork Foods; and other information appertaining to Pork Farming. By PROFESSOR JAMES LONG. Fully Illustrated with Portraits of Prize Pigs, Plans of Model Piggeries, &c. *In cloth gilt, price 10s. 6d., by post 10s. 11d.*

Pig-Keeping, Practical: A Manual for Amateurs, based on personal Experience in Breeding, Feeding, and Fattening; also in Buying and Selling Pigs at Market Prices. By R. D. GARRATT. *In paper, price 1s., by post 1s. 2d.*

Pigeons, Fancy. Containing full Directions for the Breeding and Management of Fancy Pigeons, and Descriptions of every known Variety, together with all other information of interest or use to Pigeon Fanciers. Third Edition. 18 COLOURED PLATES, and 22 other full-page Illustrations. By J. C. LYELL. *In cloth gilt, price 10s. 6d., by post 10s. 10d.*

Pigeon-Keeping for Amateurs. A Complete Guide to the Amateur Breeder of Domestic and Fancy Pigeons. By J. C. LYELL. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Polishes and Stains for Wood: A Complete Guide to Polishing Wood-work, with Directions for Staining, and Full Information for Making the Stains, Polishes, &c., in the simplest and most satisfactory manner. By DAVID DENNING. *In paper, 1s., by post 1s. 2d.*

Pool, Games of. Describing Various English and American Pool Games, and giving the Rules in full. Illustrated *In paper, price 1s., by post 1s. 2d.*

Postage Stamps, and their Collection. A Practical Handbook for Collectors of Postal Stamps, Envelopes, Wrappers, and Cards. By OLIVER FIRTH, Member of the Philatelic Societies of London, Leeds, and Bradford. Profusely Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Postage Stamps of Europe, The Adhesive: A Practical Guide to their Collection, Identification, and Classification. Especially designed for the use of those commencing the Study. By W. A. S. WESTOBY. Beautifully Illustrated. *In paper Parts, 1s. each, by post 1s. 2d. Vol. I., cloth gilt, price 7s. 6d., by post 8s.*

Postmarks, History of British. With 350 Illustrations and a List of Numbers used in Obliterations. By J. H. DANIELS. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Pottery and Porcelain, English. A Guide for Collectors. Handsomely Illustrated with Engravings of Specimen Pieces and the Marks used by the different Makers. New Edition, Revised and Enlarged. By the REV. E. A. DOWNMAN. *In cloth gilt, price 5s., by post 5s. 3d.*

Poultry-Farming, Profitable. Describing in Detail the Methods that Give the Best Results, and pointing out the Mistakes to be Avoided. By J. H. SUTCLIFFE. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Poultry-Keeping, Popular. A Practical and Complete Guide to Breeding and Keeping Poultry for Eggs or for the Table. By F. A. MACKENZIE. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Poultry and Pigeon Diseases Their Causes, Symptoms, and Treatment. A Practical Manual for all Fanciers. By QUINTIN CRAIG and JAMES LYELL. *In paper, price 1s., by post 1s. 2d.*

Poultry for Prizes and Profit. Contains : Breeding Poultry for Prizes, Exhibition Poultry and Management of the Poultry Yard. Handsomely Illustrated. Second Edition. By PROF. JAMES LONG. *In cloth gilt, price 2s. 6d., by post 2s. 10d.*

Rabbit, Book of The. A Complete Work on Breeding and Rearing all Varieties of Fancy Rabbits, giving their History, Variations, Uses, Points, Selection, Mating, Management, &c., &c. SECOND EDITION. Edited by KEMPSTER W. KNIGHT. Illustrated with Coloured and other Plates. *In cloth gilt, price 10s. 6d., by post 10s. 11d.*

Rabbits, Diseases of: Their Causes, Symptoms, and Cure. With a Chapter on THE DISEASES OF CAVIES. Reprinted from "The Book of the Rabbit" and "The Guinea Pig for Food, Fur, and Fancy." *In paper, price 1s., by post 1s. 2d.*

Rabbits for Prizes and Profit. The Proper Management of Fancy Rabbits in Health and Disease, for Pets or the Market, and Descriptions of every known Variety, with Instructions for Breeding Good Specimens. By CHARLES RAYSON. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d. Also in Sections, as follows :*

General Management of Rabbits. Including Hutches, Breeding, Feeding, Diseases and their Treatment, Rabbit Courts, &c. Fully Illustrated. *In paper, price 1s., by post 1s. 2d.*

Exhibition Rabbits. Being descriptions of all Varieties of Fancy Rabbits, their Points of Excellence, and how to obtain them. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Road Charts (Registered). For Army Men, Volunteers, Cyclists, and other Road Users. By S. W. H. DIXON and A. B. H. CLERKE. No. 1.—London to Brighton. Price 2d., by post 2½d.

Roses for Amateurs. A Practical Guide to the Selection and Cultivation of the best Roses. Illustrated. By the REV. J. HONYWOOD D'OMBRAIN, Hon. Sec. Nat. Rose Soc. *In paper, price 1s., by post 1s. 2d.*

Sailing Guide to the Solent and Poole Harbour, with Practical Hints as to Living and Cooking on, and Working a Small Yacht. By LIEUT.-COL. T. G. CUTHELL. Illustrated with Coloured Charts. *In cloth gilt, price 2s. 6d., by post 2s. 8d.*

Sailing Tours. The Yachtman's Guide to the Cruising Waters of the English and Adjacent Coasts. With Descriptions of every Creek, Harbour, and Roadstead on the Course. With numerous Charts printed in Colours, showing Deep water, Shoals, and Sands exposed at low water, with sounding. By FRANK COWPER, B.A. *In Crown 8vo., cloth gilt.*

Vol. I., the Coasts of Essex and Suffolk, from the Thames to Aldborough. Six Charts. Price 5s., by post 5s. 3d.

Vol. II. The South Coast, from the Thames to the Scilly Islands, twenty-five Charts. Price 7s. 6d., by post 7s. 10d.

Vol. III. The Coast of Brittany, from L'Abervrach to St. Nazaire, and an Account of the Loire. Twelve Charts. Price 7s. 6d., by post 7s. 10d.

Vol. IV. The West Coast, from Land's End to Mull of Galloway, including the East Coast of Ireland. Thirty Charts. Price 10s. 6d., by post 10s. 10d.

Vol. V. The Coasts of Scotland and the N.E. of England down to Aldborough. Forty Charts. Price 10s. 6d., by post 10s. 10d.

St. Bernard, The. Its History, Points, Breeding, and Rearing. By HUGH DALZIEL. Illustrated with Coloured Frontispiece and Plates. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

St. Bernard Stud Book. Edited by HUGH DALZIEL. *In cloth gilt, price 3s. 6d. each, by post 3s. 9d. each.*

Vol. I. Pedigrees of 1278 of the best known Dogs traced to their most remote known ancestors, Show Record, &c.

Vol. II. Pedigrees of 564 Dogs, Show Record, &c.

Sea-Fishing for Amateurs. Practical Instructions to Visitors at Seaside Places for Catching Sea-Fish from Pier-heads, Shore, or Boats, principally by means of Hand Lines, with a very useful List of Fishing Stations, the Fish to be caught there, and the Best Seasons. By FRANK HUDSON. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Sea-Fishing on the English Coast. The Art of Making and Using Sea-Tackle, with a full account of the methods in vogue during each month of the year, and a Detailed Guide for Sea-Fishermen to all the most Popular Watering Places on the English Coast. F. G. AFLALO. Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Sea-Life, Realities of. Describing the Duties, Prospects, and Pleasures of a Young Sailor in the Mercantile Marine. By H. E. ACRAMAN COATE. With a Preface by J. R. DIGGLE, M.A., M.L.S.B. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Seaside Watering Places. A Description of the Holiday Resorts on the Coasts of England and Wales, the Channel Islands, and the Isle of Man, giving full particulars of them and their attractions, and all information likely to assist persons in selecting places in which to spend their Holidays according to their individual tastes. Illustrated. Twenty-second Year of Issue. *In cloth gilt, price 2s. 6d., by post 2s. 10d.*

Sea Terms, a Dictionary of. For the use of Yachtsmen, Amateur Boatmen, and Beginners. By A. ANSTED. Fully Illustrated. *In cloth gilt, price 7s. 6d. nett, by post 7s. 11d.*

Shadow Entertainments, and How to Work them: being Something about Shadows, and the way to make them Profitable and Funny. By A. PATTERSON. Illustrated. *In paper, price 1s., by post 1s. 2d.*

Shave, An Easy: The Mysteries, Secrets, and Whole Art of, laid bare. Edited by JOSEPH MORTON. *Price 1s., by post 1s. 2d.*

Sheep Raising and Shepherding. A Handbook of Sheep Farming. By W. J. MALDEN, Principal of the Agricultural College, Uckfield. Illustrated. *Cloth gilt.* [In the press.]

Sheet Metal, Working in: Being Practical Instructions for Making and Mending Small Articles in Tin, Copper, Iron, Zinc, and Brass. By the Rev. J. LUKIN, B.A. Illustrated. Third Edition. *In paper, price 1s., by post 1s. 1d.*

Shorthand, on Gurney's System (Improved), LESSONS IN: Being Instructions in the Art of Shorthand Writing as used in the Service of the two Houses of Parliament. By R. E. MILLER. *In paper, price 1s., by post 1s. 2d.*

Shorthand, Exercises in, for Daily Half Hours, on a Newly-devised and Simple Method, free from the Labour of Learning. Illustrated. Being Part II. of "Lessons in Shorthand on Gurney's System (Improved)." By R. E. MILLER. *In paper, price 9d., by post 10d.*

Show Record, The. Being Part III. of "The Breeders' and Exhibitors' Record," for the Registration of Particulars concerning the Exhibition of Pedigree stock of every Description. By W. K. TAUNTON. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Skating Cards: An Easy Method of Learning Figure Skating, as the Cards can be used on the Ice. *In cloth case, price 2s. 6d., by post 2s. 9d.; leather, price 3s. 6d., by post 3s. 9d.* A cheap form is issued printed on paper and made up as a small book, *price 1s., by post 1s. 1d.*

Sleight of Hand. A Practical Manual of Legerdemain for Amateurs and Others. New Edition, Revised and Enlarged Profusely Illustrated. By E. SACHS. *In cloth gilt, price 6s. 6d., by post 6s. 10d.*

Snakes, Marsupials, and Birds. A Charming Book of Anecdotes, Adventures, and Zoological Notes. A capital Book for Boys. By ARTHUR NICOLS, F.G.S., F.R.G.S., &c. Illustrated. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Solo Whist. A Practical Manual both for Beginners and Advanced Students, with Amended Exhaustive Code of Laws. By C. J. MELROSE. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Sporting Books, Illustrated. A Descriptive Survey of a Collection of English Illustrated Works of a Sporting and Racy Character, with an Appendix of Prints relating to Sports of the Field. The whole valued by reference to Average Auction Prices. By J. H. SLATER, Author of "Library Manual," "Engravings and Their Value," &c. *In cloth gilt, price 7s. 6d. nett, by post 7s. 10d.*

Stud Record, The. Being Part II. of "The Breeders' and Exhibitors' Record," for the Registration of Particulars concerning Pedigree Stock of every Description. By W. K. TAUNTON. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Taxidermy, Practical. A Manual of Instruction to the Amateur in Collecting, Preserving, and Setting-up Natural History Specimens of all kinds. With Examples and Working Diagrams. By MONTAGU BROWNE, F.Z.S., Curator of Leicester Museum. Second Edition. *In cloth gilt, price 7s. 6d., by post 7s. 10d.*

Thames Guide Book. From Lechlade to Richmond. For Boating Men, Anglers, Picnic Parties, and all Pleasure-seekers on the River. Arranged on an entirely new plan. Second Edition, profusely Illustrated. *In cloth, price 1s. 6d., by post 1s. 9d.*

Tomato and Fruit Growing as an Industry for Women. Lectures given at the Forestry Exhibition, Earl's Court, during July and August, 1893. By GRACE HARRIMAN, Practical Fruit Grower and County Council Lecturer. *In paper, price 1s., by post 1s. 1d.*

Tomato Culture for Amateurs. A Practical and very Complete Manual on the subject. By E. C. RAVENSCROFT. Illustrated. *In paper, price 1s., by post 1s. 1d.*

Trapping, Practical: Being some Papers on Traps and Trapping for Vermin, with a Chapter on General Bird Trapping and Snaring. By W. CARNEGIE. *In paper, price 1s., by post 1s. 2d.*

Turning Lathes. A Manual for Technical Schools and Apprentices. A Guide to Turning, Screw-cutting, Metal-spinning, &c. Edited by JAMES LUKIN, B.A. Third Edition. With 194 Illustrations. *In cloth gilt, price 3s., by post 3d. 3s.*

Vamp, How to. A Practical Guide to the Accompaniment of Songs by the Unskilled Musician. With Examples. *In paper, price 9d., by post 10d.*

Vegetable Culture for Amateurs. Containing Concise Directions for the Cultivation of Vegetables in small Gardens so as to insure Good Crops. With Lists of the Best Varieties of each Sort. By W. J. MAY Illustrated. *In paper, price 1s., by post 1s. 2d.*

Ventriloquism, Practical. A thoroughly reliable Guide to the Art of Voice Throwing and Vocal Mimicry, Vocal Instrumentation, Ventriloquial Figures, Entertaining, &c. By ROBERT GANTHONY. Numerous Illustrations. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

Violins (Old) and their Makers: Including some References to those of Modern Times. By JAMES M. FLEMING. Illustrated with Facsimiles of Tickets, Sound-Holes, &c. *In cloth gilt, price 6s. 6d. nett, by post 6s. 10d.*

Violin School, Practical, for Home Students. Instructions and Exercises in Violin Playing, for the use of Amateurs, Self-learners, Teachers, and others. With a Supplement on "Easy Legato Studies for the Violin." By J. M. FLEMING. *Demy 4to, cloth gilt, price 9s. 6d., by post 10s. 2d.* Without Supplement, *price 7s. 6d., by post 8s.*

Vivarium, The. Being a Full Description of the most Interesting Snakes, Lizards, and other Reptiles, and How to Keep Them Satisfactorily in Confinement. By REV. G. C. BATEMAN. Beautifully Illustrated. *In cloth gilt, price 7s. 6d. nett, by post 8s.*

War Medals and Decorations. A Manual for Collectors, with some account of Civil Rewards for Valour. By D. HASTINGS IRWIN. Revised and Enlarged Edition. Beautifully Illustrated. *In cloth gilt, price 12s. 6d. nett, by post 12s. 10d.*

Whippet and Race-Dog, The: How to Breed, Rear, Train, Race, and Exhibit the Whippet, the Management of Race Meetings, and Original Plans of Courses. By FREEMAN LLOYD. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*

Whist, Scientific: Its Whys and Wherefores. Wherein all Arbitrary Dicta of Authority are eliminated, the Reader being taken step by step through the Reasoning Operations upon which the Rules of Play are based. By C. J. MELROSE. With Illustrative Hands printed in Colour. *In cloth gilt, price 6s., by post 6s. 6d.*

Wild Birds, Cries and Call Notes of, Described at Length, and in many instances Illustrated by Musical Notation. *In paper, price 1s., by post 1s. 2d.*

Wildfowling, Practical: A Book on Wildfowl and Wildfowl Shooting. By HY. SHARP. The result of 25 years experience Wildfowl Shooting under all sorts of conditions of locality as well as circumstances. Profusely Illustrated. *Demy 8vo, cloth gilt, price 12s. 6d. nett, by post 12s. 10d.*

Wild Sports in Ireland. Being Picturesque and Entertaining Descriptions of several visits paid to Ireland, with Practical Hints likely to be of service to the Angler, Wildfowler, and Yachtsman. By JOHN BICKERDYKE, Author of "The Book of the All-Round Angler," &c. Beautifully Illustrated from Photographs taken by the Author. *In cloth gilt, price 6s., by post 6s. 4d.*

Window Ticket Writing. Containing full Instructions on the Method of Mixing and Using the Various Inks, &c., required, Hints on Stencilling as applied to Ticket Writing, together with Lessons on Glass Writing, Japanning on Tin, &c. Especially written for the use of Learners and Shop Assistants. By WM. C. SCOTT. *In paper, price 1s., by post 1s. 2d.*

Wire and Sheet Gauges of the World. Compared and Compiled by C. A. B. PFEILSCHMIDT, of Sheffield. *In paper, price 1s., by post 1s. 1d.*

Wood Carving for Amateurs. Full Instructions for producing all the different varieties of Carvings. SECOND EDITION. Edited by D. DENNING. *In paper, price 1s., by post 1s. 2d.*

Workshop Makeshifts. Being a Collection of Practical Hints and Suggestions for the use of Amateur Workers in Wood and Metal. By H. J. S. CASSALL. Fully Illustrated. *In cloth gilt, price 2s. 6d., by post 2s. 9d.*

FICTION LIBRARY.

Decameron of a Hypnotist. Tales of Dread. By E. SUFFLING, Author of "The Story Hunter," &c. With Illustrations. *In cloth gilt, price 3s. 6d., by post 3s. 10d.*



IN PREPARATION.

THE 1899 EDITION OF

Seaside Watering Places

(23rd YEAR OF PUBLICATION).

A Description of over 250 Holiday Resorts on the Coasts of England and Wales, the Isle of Wight, the Channel Islands, and the Isle of Man, including the gayest and most quiet places, giving full particulars of them and their attractions, and all other information likely to assist persons in selecting places in which to spend their Holidays according to their individual tastes; with Business Directory of Tradesmen, so that Visitors can send orders in advance of their arrival.

Corrections, Directory Announcements, and Advertisements should now be sent in.

PROSPECTUSES FREE ON APPLICATION.

London : L. Upcott Gill, 170, Strand, W.C.

P. T. O.

A Supplement *to that
Splendid Book,*

NICHOLSON'S
**Dictionary of
Gardening,**

Is in preparation, bringing this great work on the Art and Practice of Horticulture right up to date. This is the finest work on Gardening at present existing, and the Supplement—which is magnificently illustrated—will make it the newest.

*It is expected that the first portion will be ready
at an early date.*

THE SEA SERVICES.

A Guide to the Royal Navy and Mercantile Marine,
INCLUDING
PILOT, COASTGUARD, LIFEBOAT, LIGHTSHIP,
WATER POLICE, AND CUSTOMS SERVICE.

By A. COWIE.

Life Studies in Palmistry.

The hands of notable persons read according to
the practice of Modern Palmistry.

ILLUSTRATED.

By INA OXENFORD.

LONDON:

L. UPCOTT GILL, 170, STRAND, W.C.

PUBLISHED BY E. and F. N. SPON, Ltd.

Crown 4to, full gilt, fancy cloth, 478 pages Letterpress and 735 Engravings, price 7s 6d.

POPULAR ENGINEERING:

BEING INTERESTING AND INSTRUCTIVE EXAMPLES IN

**CIVIL, MECHANICAL, ELECTRICAL, CHEMICAL, MINING,
MILITARY, and NAVAL ENGINEERING.**

GRAPHICALLY AND PLAINLY DESCRIBED AND

Specially Written for those about to enter the Engineering Profession and the
Scientific Amateur. With Chapters upon

PERPETUAL MOTION and ENGINEERING COLLEGES and SCHOOLS.

By F. DYE.

SPONS' MECHANICS' OWN BOOK:

A MANUAL FOR HANDICRAFTSMEN AND AMATEURS.

Complete in One large Vol., demy 8vo, cloth, containing 700 pp. and 1420 Illustrations.

Fourth Edition, 6s.; or half-bound, French morocco, 7s. 6d.

Contents :

Mechanical Drawing ; Casting and Founding in Iron, Brass, Bronze, and other Alloys ; Forging and Finishing Iron ; Sheet Metal Working ; Soldering, Brazing, and Burning ; Carpentry and Joinery, embracing descriptions of some 400 woods ; over 200 Illustrations of Tools and their Uses ; Explanations (with Diagrams) of 116 Joints and Hinges, and Details of Construction of Workshop Appliances ; Rough Furniture, Garden and Yard Erections, and House-Building ; Cabinet-making and Veneering ; Carving and Fret-cutting ; Upholstery ; Painting, Graining, and Marbling ; Staining Furniture, Woods, Floors, and Fittings ; Gilding, Dead and Bright, on various Grounds ; Polishing Marble, Metals and Wood ; Varnishing ; Mechanical Movements, illustrating contrivances for transmitting Motion ; Turning in Wood and Metals ; Masonry, embracing Stonework, Brickwork, Terra-cotta, and Concrete ; Roofing with Thatch, Tiles, Slates, Felt, Zinc, &c. ; Glazing with and without Putty, and Lead Glazing ; Plastering and Whitewashing ; Paper-hanging ; Gas-fitting ; Bell-hanging, Ordinary and Electric Systems ; Lighting ; Warming ; Ventilating ; Roads, Pavements and Bridges ; Hedges, Ditches and Drains ; Water Supply and Sanitation ; Hints on House Construction suited to New Countries.

SPONS' HOUSEHOLD MANUAL :

*A TREASURY OF DOMESTIC RECEIPTS AND GUIDE FOR
HOME MANAGEMENT.*

Demy 8vo, cloth, containing 957 pp. and 250 Illustrations, price 7s. 6d. ; or half-bound
French morocco, 9s.

Principal Contents :

Hints for selecting a good House ; Sanitation ; Water Supply ; Ventilation and Warming ; Lighting ; Furniture and Decoration ; Thieves and Fire ; The Larder ; Curing Foods for lengthened Preservation ; The Dairy ; The Cellar ; The Pantry ; The Kitchen ; Receipts for Dishes ; The Housewife's Room ; Housekeeping, Marketing ; The Dining-room ; The Drawing-room ; The Bed-room ; The Nursery ; The Sick-room ; The Bath-room ; The Laundry ; The School-room ; The Playground ; The Work-room ; The Library ; The Garden ; The Farmyard ; Small Motors ; Household Law.

London : E. & F. N. SPON, Ltd., 125, Strand.

New York : SPON & CHAMBERLAIN, 12, Cortlandt Street.

DOG SOAP

MADE BY

SPRATT'S PATENT LIMITED.

A NON-POISONOUS PREPARATION.

Invaluable for Preparing the Coat for Exhibition.

SOLD IN TABLETS.

DOG MEDICINES.

Alterative Cooling Powders
Aperient Tasteless Biscuits
Chronic Skin Disease Cure
Cough Pills
Chemical Food
Chorea Pills (St. Vitus' Dance)
Diarrhoea Mixture
Distemper Powders
Distemper Pills
Disinfectant for Kennels
Ear Canker Lotion
Eczema Lotion
Eye Lotion
Hair Stimulant

Jaundice or "Yellows" Pills
Locurium Oil (Patent) for Animal
Use
Locurium Oil (Patent) for
Human Use (including Govern-
ment Stamp)
Mange Lotion
Purging Pills
Rheumatic and Sprain Liniment
Rheumatic and Chest Founder Pills
Tonic Condition Pills
Vegetable Puppy Vermifuge
Worm Powders
Worm Pills

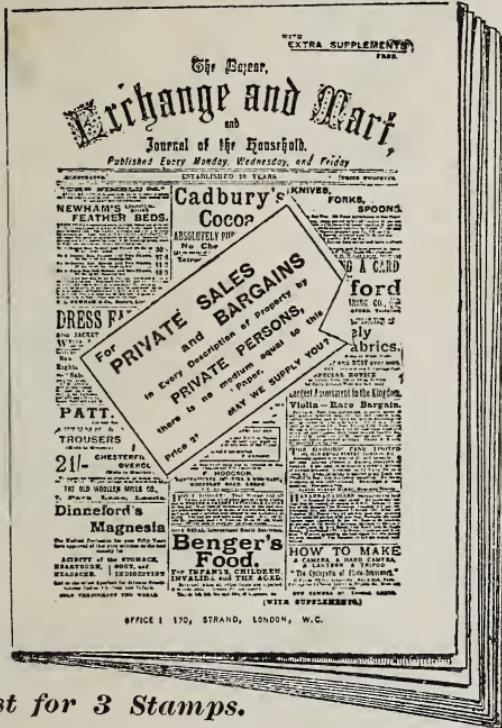
YOUR TRADESMAN OR STORES WILL SUPPLY YOU.

Spratt's Patent Limited, Bermondsey, London, S.E.
PAMPHLET ON CANINE DISEASES, POST FREE.

BARGAINS

paper, which is used by Private Persons for disposing of things they no longer require. **THE** paper for Buying, Selling and Exchanging by *Private Persons*. Get a copy and judge for yourself.

TELEGRAMS: "BAZAAR, LONDON."



2d.
at
Newsagents.

2d.
at
Bookstalls.

By post for 3 Stamps.

OFFICE: 170, STRAND, LONDON.

ADVICE

Eminent Experts of any paper in the Kingdom, and these Experts freely advise its readers. **THE** paper for Amateurs. Get a copy and judge for yourself.

EXTRA SUPPLEMENTS Well Illustrated.

- The Ladies' (Fashions), each Month, 1st Wed.;
- The Philatelists' (Stamps), 2nd Wed.;
- The Home (Domestic), 3rd Wed.
- The Cyclists' (Wheeling), 1st Mon.;
- The Sportsman's (Sport), 2nd Mon.;
- The Garden (Horticulture), 3rd Mon.;
- The Dog Owners' (Dogs), Last Mon.

in Everything and Anything are readily secured through *The Bazaar, Exchange and Mart* News-

paper for Buying, Selling and Exchanging by *Private Persons*. Get a copy and judge for yourself.

WOOD!

WOOD!!

WOOD!!!

For Fretworkers, Woodcarvers, and Others.

WRITE TO _____

COBBETTS,

62-64, and 66, Virginia Road, Bethnal Green,
LONDON, E.,

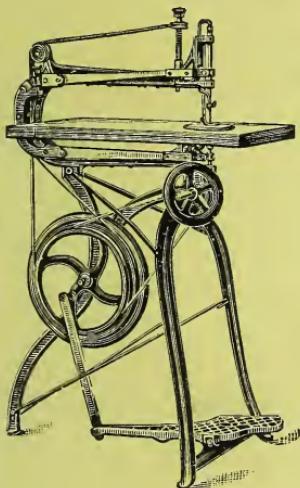
FOR PRICE LIST. . . .

TELEGRAMS:
HUSTINGS, LONDON.

TELEPHONE NO.
514 AVENUE.

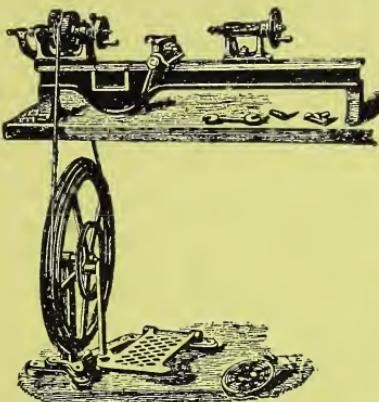
Well known all over the Country.

**NEW
No. 8 Fret Saw**



20in. under arm. Foot to keep work down. Horizontal and Vertical Drill. True Vertical stroke. Table tilts to any angle. Tension instantly removed or tightened.

**No. 3 6/84
Back-Geared Lathe.**



A FIRST-CLASS, well-finished Lathe, with machine-planed iron bed, plain or with gap; back-gearied head-stock, cast-steel mandrel, conical necks, tail pin running through; adjusting screw, and lock nuts to take up wear; 3-speed bright turned cone pulley; steel centres, tail-stock with cylinder mandrel, square thread traverse screw; eccentric hand rest and two tees and catchplate as shown. Weight, on Stand complete, 149lbs.

**Bed 30in. long, and 3in. centres,
turning 18in. by 6in.**

We are bona-fide Makers and Designers of 250 varieties of Lathes and other Wood and Metal working machinery.

Send SIX Stamps for Catalogue.

LONDON SHOW ROOMS: 100 & 101, HOUNDSDITCH.

**BRITANNIA CO.,
COLCHESTER.**



